NEOCOMIAN AMMONITES FROM NORTHERN AREAS OF PAKISTAN

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By A. N. FATMI

CONTENTS

ABSTRACT

Neocomian (Berriasian–Valanginian) ammonites from the Trans Indus Ranges in the Punjab Province and from the Samana Range and Khadimakh in Western Kohat, North West Frontier

province of Pakistan, are described. The Berriasian is represented by the ammonite genera *Subthurmannia* (abundant), *Protacanthodiscus, Berriasella, Spiticeras* (*Spiticeras*), *Spiticeras* (*Negreliceras*), *Neocosmoceras, Bochianites* and *Neolissoceras*. Ammonites of Lower Valanginian age belong mostly to the genera *Thurmanniceras, Neocomites* (*Neocomites*), *Neocomites* (*Parandiceras*), *Neohoploceras, Sarasinella* and *Kilianella*. The Upper Valanginian is represented by abundant *Olcostephanus* (*Olcostephanus*), with *Olcostephanus* (*Rogersites*), *Neohoploceras, Lyticoceras, Leopoldia* and *Distoloceras*.

The Neocomian ammonites are distributed in the uppermost beds of the lower member and the whole of the middle member of the Chichali Formation. The rest of the lower member is Upper Jurassic while the upper member of the formation is devoid of ammonites in these areas.

The new species *Neocomites* (*Neocomites*) *copei* and *Neohoploceras collignoni* are erected, and new variants *isakhelensis* of *Olcostephanus* (*Rogersites*) *madagascariensis, surgharensis* of *Subthurmannia femori* and *noori* of *S. transitoria* proposed.

I. INTRODUCTION

Ammonites of Neocomian (Berriasian–Valanginian) age are described from the Trans Indus Ranges (a westerly extension of the Salt Range) in the Punjab Province and from Western Kohat (Samana Range and its westerly extension into Khadimakh) in the North West Frontier Province of Pakistan (Fig. 1). A detailed account of the stratigraphy of the Jurassic and Lower Cretaceous rocks (including the Neocomian beds) and of the Jurassic ammonites from northern areas of Pakistan has been

Fig. 1. Fossil locality map of Hazara, Kala Chitta, Kohat, Trans Indus Ranges and Shaikh Budin Hills, Pakistan.

already published (Fatmi 1972). This paper is a sequel and deals only with the systematic descriptions of the Neocomian ammonites from the Chichali Formation.

The most important contributions to knowledge of the ammonite faunas of this region are by Spath (1930, 1939), who described in detail the cephalopods of the Neocomian Belemnite Beds of the Salt Range (1939) and established some important genera and many new species from this region. In 1930 he had established the presence of Neocomian beds at Khadimakh in Western Kohat on an *Olcostephanus* fragment collected by Davis (1930) from Khadimakh. The ammonites described in the present paper were collected from some localities known to Spath in the western extension of the Salt Range, and from newly discovered localities and horizons. The ammonites of Berriasian and Upper and Lower Valanginian age from the Samana Range and Khadimakh in Western Kohat are recorded for the first time. The discussion of Neocomian ammonites from the Trans Indus Ranges, mainly a revision of Spath's work, includes some forms not recorded before, and there is new information on the stratigraphic position of the faunas within the Chichali Formation which was not precisely known previously.

This paper forms a part of the author's Ph.D. thesis submitted to the University of Wales (University College of Swansea) in 1968. Since the publication of the major part of the thesis (Fatmi 1972) the Neocomian ammonites have been revised and brought up to date. Many colleagues and friends in and outside Pakistan have already been acknowledged (Fatmi 1972 : 305). For this paper I am deeply indebted to Dr M. K. Howarth for his guidance and critical review of the fauna and text. Sincere thanks are also due to Dr P. F. Rawson of Queen Mary College, London, who through the courtesy of Dr Howarth reviewed the identifications and offered many useful suggestions. Mr D. Phillips and other members of staff of the Department of Palaeontology of the British Museum (Natural History) are thanked for reorganizing and photographing the specimens.

The systematic descriptions mostly carry the standard morphological terms as defined in Part L of the *Treatise on Invertebrate Paleontology* (Arkell *et al.* 1957). The standard dimensions (diameter, whorl height, whorl breadth, umbilical width) are given in millimetres and as percentages of the diameter. Stratigraphical field measurements are given in feet as originally made (Fatmi 1972 : 302) with approximate metric conversions.

II. STRATIGRAPHIC SUMMARY

Neocomian ammonites occur in the Chichali Formation of Upper Jurassic to Lower Cretaceous age. The name Chichali Formation was introduced by Danilchik (1961) and Danilchik & Shah (1967), from the Chichali Pass in the Trans Indus Ranges, and it has since been approved by the Stratigraphic Committee of Pakistan for rocks previously referred to as 'Belemnite Beds' and 'Belemnite Shale' (Davies 1930, Spath 1939, Gee 1945, Pascoe 1959, Krishnan 1960).

The stratigraphic position of the formation in the area is as follows.

Lumshiwal Formation (Sandstone)	Lower Cretaceous (Aptian to Albian)
Chichali Formation (glauconitic sandstone and sandy shale)	Upper Jurassic to Neocomian
~~ DISCONFORMITY ~~~~~~~~	
Samana Suk Limestone (Limestone and Marl)	Middle Jurassic

The Chichali Formation (for details see Fatmi 1972) consists of dark green to dark greenish grey (weathering partly as rusty brown to purple) sandstones and sandy shales which are glauconitic and chamositic and include calcareous, phosphatic, silty concretions, lenses and nodules. Most of the ammonites occur in nodules and are mainly preserved as internal moulds, but some have recrystallized shell material.

The Chichali Formation is divisible into three members in the Trans Indus and Samana Ranges, but at Khadimakh the upper member is similar to the overlying Lumshiwal Formation in lithology and thus only the lower two divisions are recognizable. The thickness of the formation varies from a maximum 185 feet (56 m) in section in the Trans Indus Ranges to a minimum of 50 feet (15 m) in Western Kohat. The three members are as follows.

Upper	Soft sandstone and sandy shale, glauconitic and chamositic, poor in fossils.	25–60 feet ($7\frac{1}{2}$–18 m)
Middle	Sandstone, massive, rusty brown to greenish, glauconitic, calcareous, phosphatic, with frequent ammonites and abundant belemnites (*Hibolithes*).	20–30 feet (6–9 m)
Lower	Soft sandstone and sandy shale, dark green to dark greenish grey, glauconitic with ammonites and abundant belemnites.	7–75 feet (2–23 m)

The Neocomian ammonites occur in the middle member and the upper part of the lower member of the formation. The upper member is poor in fossils (excepting for some bivalves and a few *Hibolithes*) and is regarded as Upper Neocomian (post-Valanginian). The rest of the lower member has an Upper Jurassic fauna. The Berriasian ammonites occur in the upper 2 to 3 feet (c. $\frac{3}{4}$ m) of the lower member and basal 3 to 4 feet (c. 1 m) of the middle member; the rest of the middle member contains the Valanginian fauna.

III. FAUNAL SUMMARY

Since the presentation of the thesis (1968) and the publication of my earlier paper (Fatmi 1972) a revision of the Neocomian faunas has been made. This has

necessitated changes in the identification of a few forms I referred to previously (1972 : 319, 320, 362 ; fig. 6) ; the correct identification of these ammonites should now be taken as follows.

1. *Neocomites* (*Odontodiscoceras*) *similis* Spath to be regarded as *Neocomites* (*N.*) *similis* Spath (p. 280).
2. *Neocomites* (*Parandiceras*) *theodorii* (Oppel) and *Neocomites* (*P.*) aff. *indicus* (Uhlig) are to be regarded as variants of *N.* (*P.*) *rota* Spath (p. 282).
3. *Kilianella* sp. nov. is now considered to be *Neocomites* (*N.*) *campylotoxus* (Uhlig) (p. 279).
4. *Subthurmannia* forms referred doubtfully to *S. boissieri* (Pictet) and *S. pseudopunctata* Spath are regarded now as sp. indet. (p. 275).
5. The 'subspecies' of *Olcostephanus* (*O.*) *salinarius* Spath referred to previously are treated now as variants (p. 266).
6. Forms referred to *Olcostephanus* (*O.*) cf. *filosa* (Baumburger) and *O.* (*O.*) aff. *geei* Spath are included in *O.* (*O.*) *sakalavensis* (Besairie) (p. 267).
7. The specimen referred to *Olcostephanus* (*Rogersites*) sp. nov. is now regarded as a new variant of *O.* (*R.*) *madagascariensis* Lemoine (p. 272).
8. The globular forms referred to *Olcostephanus* (*O.*) *pachycyclus* Spath are included in *O.* (*O.*) *globosus* Spath (p. 270).
9. Some species referred previously to the subgenus *Calliptychoceras* are included in the subgenus *Neocomites* (p. 279).

The Berriasian forms which occur in the basal middle and uppermost lower members of the Chichali Formation include species of the genera *Subthurmannia* (abundant), *Berriasella, Protacanthodiscus, Spiticeras* (*Spiticeras*), *Spiticeras* (*Negreliceras*), *Bochianites* and *Neolissoceras.*

The Lower Valanginian (middle member of the Chichali Formation) is represented by *Thurmanniceras, Sarasinella, Neocomites* (*Neocomites*), *Neocomites* (*Parandiceras*), *Uhligites, Kilianella* and *Neohoploceras.*

The Upper Valanginian fauna occurs in the upper 2 to 3 feet (c. $\frac{3}{4}$ m) of the middle member of the Chichali Formation and consists of *Olcostephanus* (*Olcostephanus*) (abundant), *O.* (*Rogersites*), *Neohoploceras, Leopoldia, Distoloceras* and *Lyticoceras.*

IV. SYSTEMATIC DESCRIPTIONS

Class *CEPHALOPODA*

Sub-class *AMMONOIDEA*

Order LYTOCERATIDA

Superfamily **ANCYLOCERATACEAE** Meek 1876

Family **BOCHIANITIDAE** Spath 1922

Genus ***BOCHIANITES*** Lory 1898

Bochianites cf. ***gerardianus*** (Stoliczka 1866)

1866 *Anisoceras gerardianum* Stoliczka : 110 ; pl. X, fig. 3.
1910 *Bochianites gerardianus* (Stoliczka) Uhlig : 381 ; pl. LXXIX, figs 3a–f.

MATERIAL. One specimen, C.79100.

HORIZON. Lower part of the middle member of the Chichali Formation ; Berriasian.

REMARKS. The specimen (a body chamber fragment) has an oval whorl section and simple strongly prorsiradiate ribs which cross the venter with forward arching but are weak along the siphonal line. There is one prorsiradiate constriction at the adoral end. The specimen closely resembles the holotype from Spiti, Himalaya, which was refigured by Uhlig (1910). It is reported for the first time from the Trans Indus Ranges.

LOCALITY. Lunda Mines, Trans Indus Ranges.

Order AMMONITIDA
Superfamily **HAPLOCERATACEAE** Zittel 1884
Family **HAPLOCERATIDAE** Zittel 1884
Genus ***NEOLISSOCERAS*** Spath 1923
Neolissoceras grasianum (d'Orbigny 1841)
Pl. 1, figs 1, 2

1841 *Ammonites grasianus* d'Orbigny : 141 ; pl. XLIV.
1939 *Neolissoceras grasianum* (d'Orbigny) Spath : 8 ; pl. I, figs 4a–d (with synonymy).

MATERIAL. Four specimens, C.79101–4.

HORIZON. Basal middle and top of lower members of the Chichali Formation in the Trans Indus Ranges, and lower part of dark rusty brown member of the Chichali Formation at Khadimakh (Western Kohat) ; Berriasian.

DESCRIPTION. The figured specimens are septate and have an involute, smooth shell. The whorl section is subrectangular with flat to gently concave flanks and broadly arched venter. The umbilicus is narrow and has a well-defined umbilical shoulder with a slanting umbilical wall.

DIMENSIONS. C.79101 – 50 : 25·0 (50%), 15·8 (31%), 9·5 (19%).
C.79102 – 28 : 14·0 (50%), 9·0 (32%), 5·5 (19%).

REMARKS. Spath (1939) figured a similar form from the Trans Indus Range, and assigned to it a Valanginian age. The specimens figured here were collected from a stratigraphic horizon that has yielded *Subthurmannia*, suggesting a Berriasian age. It is very likely that Spath's specimens (collected by other workers) also came from the present level.

LOCALITIES. Chichali Pass, Punnu Mines, south-west of Malla Khel in the Trans Indus Ranges, and Khadimakh in Western Kohat.

Family **OPPELLIDAE** Bonarelli 1894
Subfamily **STREBLITINAE** Spath 1925
Genus ***UHLIGITES*** Kilian 1907
Uhligites sp. indet.

MATERIAL. One specimen, C.79105.

HORIZON. About 7 feet (2 m) below the top of the middle member of the Chichali Formation ; Valanginian.

REMARKS. The specimen, which is poorly preserved, is of moderately large size (240 mm diameter) and has an oxyconic, very involute shell. The whorl section is compressed, with gently arched flanks which are convergent towards an acutely rounded to subtabulate venter. The suture line is highly complex.

LOCALITY. South-west of Malla Khel, Trans Indus Ranges.

Superfamily **PERISPHINCTACEAE** Steinmann 1890

Family **OLCOSTEPHANIDAE** Haug 1910

Subfamily **SPITICERATINAE** Spath 1924

Genus ***SPITICERAS*** Uhlig 1903

Subgenus ***SPITICERAS*** Uhlig 1903

Spiticeras (Spiticeras) cf. ***griesbachi*** (Uhlig 1903)

Pl. 1, fig. 4

1903 *Holcostephanus* (*Spiticeras*) *griesbachi* Uhlig : 115 ; pl. XI, figs 3a–d.

MATERIAL. One specimen, C.79106.

HORIZON. Upper part of the lower member of the Chichali Formation in the Samana Range, Western Kohat ; Berriasian.

DESCRIPTION. The septate specimen has an evolute shell, an oval whorl section (whole height 35 mm and whole breadth 30 mm), with flattish flanks and an evenly rounded venter. The umbilicus is wide. The umbilical wall is rounded. Prominent constrictions are present. The ribs are slightly prorsiradiate and cross the venter with a forward swing, and are bundled rather irregularly at prominent umbilical tubercles. Branching of ribs takes place at the umbilical shoulder and slightly below the middle of the flank.

REMARKS. The figured specimens compare favourably in ornamentation and whorl section with the holotype from Lochambelkichak, Spiti. In ornamentation it may be compared with *Spiticeras* (*S.*) *scriptus* (Strachey) figured by Uhlig (1910 : pl. XV, figs 1a–g ; pl. LVIII, figs 2a–c) but differs in having a more elevated whorl section and prominent bullae. The species is recorded for the first time from the Samana Range.

LOCALITY. South of Fort Lockhart, Samana Range.

Spiticeras (Spiticeras) mojsvari (Uhlig 1903)

Pl. 1, fig. 3

1903 *Holcostephanus* (*Spiticeras*) *mojsvari* Uhlig : 110 ; pl. XVII, figs 1a–d.

MATERIAL. One specimen, C.79107.

HORIZON. Lower part of rusty brown sandstone member of the Chichali Formation at Khadimakh, Western Kohat ; Berriasian.

DESCRIPTION. The specimen is septate and has a moderately evolute and inflated shell. It has a whorl height of 33 mm and whorl thickness of 36 mm. The flanks are subparallel on the lower half but arched and convergent on the upper half, and the venter is arched. The umbilical wall is almost vertical. One deep constriction is present.

The straight, prorsiradiate ribs swing forwards across the venter, but are weak on the siphonal line. They are bundled at prominent blunt umbilical bullae. The ribs also bifurcate higher up on the flank.

REMARKS. The figured specimen compares favourably with Uhlig's holotype from Lochambelkichak, Spiti, which at 114 mm diameter has a whorl height of 33 mm and whorl breadth of 45 mm. It may also be compared with *Spiticeras* (*Spiticeras*) *scriptus* (Strachey) as figured by Uhlig (1910 : pl. LVIII, figs 2a–c ; pl. XV, figs 3a–d), but it differs in having more compressed whorls and more ribs.

LOCALITY. Khadimakh (south flank), Kohat district.

Subgenus ***NEGRELICERAS*** Djanélidzé 1922

Spiticeras (Negreliceras) tenuicostatum Djanélidzé 1922

Pl. 2, fig. 2

1922 *Spiticeras* (*Negreliceras*) *tenuicostatum* Djanélidzé : 106 ; pl. VII, figs 4, 5.
1939 *Spiticeras* (*Negreliceras*?) sp. nov. aff. *subnegreli* Djanélidzé ; Spath : 38 ; pl. II, figs 9a–d.

MATERIAL. Three specimens, C.79108–10.

HORIZON. Basal part of the middle member of the Chichali Formation ; Berriasian.

DESCRIPTION. The shell is rather involute, compressed and approximately 150 mm in diameter. The whorl section is elliptical, much higher than wide on the outer whorl and less so on the inner whorls. The flanks are flat, convergent towards a rounded venter, and the maximum thickness is near the umbilical shoulder. The umbilical wall is steeply inclined. Constrictions, more prorsiradiate than the ribs, are present on the inner whorl fragments.

The ribs are dense and rather weak on the lower half of the flank and the venter, but prominent on the upper half of the flank. The primary ribs are coarse, rursiradiate on the umbilical wall, but recurve to become rectiradiate, and swell into elongated blunt tubercles at the umbilical shoulder and lowermost part of the flank. At 150 mm diameter the prorsiradiate primary ribs extend to about the middle of the flank, and on the upper half of the flank they give place to sheaves of 2 to 4 secondary ribs which are bundled irregularly. Less commonly the branching of ribs also takes place irregularly on the lower third of the flank and at the umbilical shoulder. In addition there are some irregular intercalatory ribs which extend about half way down on the flank. All the ribs are moderately prorsiradiate, are projected further forwards on the venter but weaken along the siphonal line. There are 13 primary ribs and tubercles per half whorl at 150 mm diameter.

DIMENSIONS. C.79108 – c. 150·0, c. 58·0 (39%), ? 36·0 (25%), 48·0 (32%).

REMARKS. The species differs from *S.* (*Negreliceras*) *subnegreli* Djanélidzé in being much more involute, in having a more elevated whorl section, and different rib style at a larger diameter. The inner whorl fragments also show a less compressed whorl section with greater whorl breadth. There is, however, strong resemblance in ventral and side view, particularly in the forward projection of ribs near the ventral margin and on the venter. The number and nature of the primary ribs and umbilical tubercles are also very similar.

In whorl section the species is comparable with *S.* (*Negreliceras*) *ducalis* (Matheron 1880 : pl. B27, figs 2a–b) but differs in being more involute and in having a different rib style at a comparative diameter.

Spath (1939 : pl. II, figs 9a–d) described a fragmentary specimen from a nearby locality in the Trans Indus Ranges as *Spiticeras* (*Negreliceras*) sp. nov. aff. *subnegreli* Djanélidzé. The inner whorl fragments of the described species are very similar to Spath's form and because of their greater involution may belong to *S.* (*Negreliceras*) *tenuicostatum*.

LOCALITIES. South-west of Malla Khel and Punnu Mines, Trans Indus Ranges.

Subfamily **OLCOSTEPHANINAE** Haug 1910

Genus ***OLCOSTEPHANUS*** Neumayr 1875

Subgenus ***OLCOSTEPHANUS*** Neumayr 1875

Olcostephanus (Olcostephanus) salinarius Spath 1939

Pl. 1, figs 5, 6 ; Pl. 2, fig. 4 ; Pl. 3, fig. 1

1930 *Olcostephanus* aff. *astierianus* (d'Orbigny) Spath : 58 ; pl. VII, figs 4, 5.
1939 *Olcostephanus salinarius* Spath : 13 ; pl. I, figs 1a–b, 8a–b.
1972 *Olcostephanus* (*Olcostephanus*) *salinarius* subspp. ; Fatmi : 319–20.

MATERIAL. Fifteen specimens, C.79111–25.

HORIZON. Upper part of the middle member of the Chichali Formation in the Trans Indus Ranges and Samana Range, and the upper part of the rusty brown sandstone member of the Chichali Formation at Khadimakh (Western Kohat) ; Upper Valanginian.

DESCRIPTION. The collection contains 7 complete adult specimens in which all or part of the flared mouth border is preserved ; four of them have large triangular lateral lappets at their final diameters of 93, 82, 81 and 53 mm ; the other three are c. 83, 80 and c. 64 mm in diameter at their apertures, but their mouth borders are partly broken away and lappets are not preserved. The modifications at the aperture (Pl. 1, fig. 5 ; Pl. 2, fig. 4) start with a highly oblique flared rib followed by a constriction, then the mouth border itself consisting of a large lateral projection between the umbilical seam and the middle of the whorl side, the large triangular lappet on the upper half of the whorl side, and a large rib over the venter projecting upwards. The adult body chamber is about $\frac{3}{4}$ of a whorl long. All these specimens are microconchs. The other 8 specimens are smaller and incomplete.

The shell is involute and has a depressed rounded whorl section, with steep but rounded umbilical walls. The primary ribs are strongly rursiradiate on the umbilical slope and give place to radially elongated tubercles at the umbilical edge. Bundles of 3 to 5 ribs issue from the tubercles ; they are prorsiradiate on the middle of the flanks then recurve to rectiradiate or gently rursiradiate on the upper part of the flanks and across the venter. Occasionally there are intercalated secondary ribs.

DIMENSIONS. C.79111 – 60·0 : 24·0 (40%), 28·5 (48%), 19·0 (32%).
C.79114 – 42·0 : 18·0 (43%), 24·0 (57%), 12·0 (29%).
C.79116 – 79·0 : 32·0 (41%), 4·0 (51%), 26·5 (34%).
C.79117 – 48·0 : 18·0 (38%), 25·5 (53%), 16·5 (34%).
C.79118 – 80·0 : 32·0 (40%), 38·0 (48%), 22·5 (28%).
C.79120 – 86·0 : 34·0 (40%), 40·0 (47%), 24·5 (28%).
C.79121 – 33·0 : 14·5 (44%), 20·0 (61%), 10·0 (30%).
C.79122 – 55·0 : 19·0 (35%), 30·5 (55%), 20·5 (37%).

REMARKS. *Olcostephanus* (*O.*) *salinarius* Spath is the most common species of the genus in the Trans Indus Ranges, and has been recognized from the Samana Range and Khadimakh in Western Kohat. The species shows a fair range of variation in the density and strength of the primary and secondary ribs, the lateral tubercles and in involution, which made Spath recognize a number of variants of the species. Var. *crassa* (Spath 1939 : pl. I, fig. 3) is characterized by fewer secondary ribs and greater whorl inflation, while var. *obesa* (Spath 1939 : pl. II, fig. 5) is characterized by a more evolute shell. Spath's two other varieties, namely *involuta* (1939 : pl. I, fig. 2) and *subfilosa* (1939 : pl. I, fig. 6) are more closely related to *Olcostephanus* (*O.*) *sakalavensis* (Besairie 1936 : 139 ; pl. XIII, figs 10–12) because of their more involute shells, weaker primary ribs and umbilical tubercles, and finer secondary ribs.

The holotype figured by Spath (1939 : pl. I, fig. 1) has lappets at its mouth border at 70 mm diameter, and three other specimens figured by him have mouth borders and lappets at c. 71, 69 and 60 mm diameter. All the known adults of *O. salinarius* are thus microconchs ranging from 53 to 93 mm diameter ; the accompanying macroconchs are not known, though it is possible that they may be those specimens described below as *O. fascigerus* and *O. sublaevis*.

LOCALITIES. Many localities in the Trans Indus and Samana Ranges, and Khadimakh in Western Kohat.

Olcostephanus (Olcostephanus) sakalavensis (Besairie 1936)

Pl. 2, figs 1, 3 ; Pl. 3, fig. 2 ; Pl. 4, fig. 3

1936 *Rogersites sakalavensis* Besairie : 139 ; pl. XIII, figs 10–12.
1939 *Olcostephanus sakalavensis* (Besairie) Spath : 138 ; figs 5a–b.
1939 *Olcostephanus salinarius*, varieties *subfilosa* and *involuta* Spath : 13 ; pl. I, figs 2, 6a–b ; pl. II, fig. 4.
1939 *Olcostephanus victoris* Spath : 20 ; pl. XIX, figs 7a, b.
1939 *Olcostephanus geei* Spath : 26 ; pl. VII, figs 5–6.
1972 *Olcostephanus* (*Olcostephanus*) cf. *filosa* (Baumberger) ; Fatmi : 320.
1972 *Olcostephanus* (*Olcostephanus*) aff. *geei* Spath ; Fatmi : 320.

MATERIAL. Ten specimens, C.79126–35.

HORIZON. Top bed of the middle member of the Chichali Formation in the Trans Indus Ranges, and top bed of the rusty brown sandstone member at Khadimakh, Western Kohat ; Valanginian (Upper).

DESCRIPTION. The species is represented by a number of septate specimens of moderate size and involution. The whorl section is subcircular to oval, wider than high with arched flanks and venter. The umbilicus is narrow and deep, with a steep umbilical wall and rounded shoulder.

The ribs are rursiradiate on the umbilical wall and swell into small rather weak tubercles at the umbilical edge. Coming from these tubercles are bundles of 4 to 7 fine ribs which are prorsiradiate on the flanks then recurve to become rectiradiate across the venter. A few ribs occasionally bifurcate higher up on the flank and there are occasional intercalated ribs.

DIMENSIONS. C.79126 – 54·0 : 24·0 (44%), 28·0 (52%), 13·0 (24%).
C.79127 – 87·0 : 42·0 (48%), 47·0 (54%), 18·0 (21%).
C.79131 – 48·0 : 20·0 (42%), 30·0 (63%), 13·0 (27%).
C.79132 – 55·0 : 27·0 (49%), 30·0 (64%), 10·5 (19%).

REMARKS. *Olcostephanus* (*O.*) *sakalavensis* (Besairie) differs from *O.* (*O.*) *salinarius* Spath in being more involute, more finely and densely ribbed, and in having smaller and weaker umbilical tubercles.

The varieties *subfilosa* and *involuta* described by Spath (1939 : 13 ; pl. I, figs 6a–b ; pl. I, fig. 2 ; pl. II, fig. 4) under *Olcostephanus salinarius* Spath seem to be more closely related to *O. sakalavensis* (Besairie) in their weaker umbilical tubercles, finer ribs and greater involution than *salinarius*. *Olcostephanus* (*O.*) *victoris* Spath (1939 : 20 ; pl. XIX, figs 7a, b) (dimensions : 105, 43%, 54%, 26%) and *Olcostephanus* (*O.*) *geei* Spath (1939 : 26 ; pl. VII, figs 5, 6) (dimensions : 65, 46%, 60%, 20%) are considered here as synonyms of *O. sakalavensis* (Besairie), for both specimens are finely ribbed and have weaker lateral tubercles similar to those of *O. sakalavensis*.

The species is second in order of abundance to *O. salinarius*, and is reported for the first time from the Western Kohat and Trans Indus Ranges.

LOCALITIES. Chichali Pass, south-west of Malla Khel, Makerwal in the Trans Indus Ranges and south of Khadimakh in Western Kohat.

Olcostephanus (Olcostephanus) fascigerus Spath 1939

Pl. 3, fig. 3

1939 *Olcostephanus fascigerus* Spath : 18 ; pl. IV, figs 1–3.

MATERIAL. One specimen, C.79136.

HORIZON. Top bed of the middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. The whorl section is depressed, subcircular, with arched flank and venter. The umbilicus is narrow and has a steep, high, curved umbilical wall and rounded umbilical shoulder. Shallow constrictions are present.

The ribs are rursiradiate or rectiradiate on the umbilical wall, and at the umbilical shoulder they give way to sharp elongated tubercles. Derived from these tubercles are bundles of 4 to 6 ribs which are prorsiradiate on the flanks, then recurve to rectiradiate across the venter. One or two secondary ribs are intercalated. Approximately 14 primary and 70 secondary ribs are present at 90 mm on the half whorl specimen.

Dimensions. C.79136 – 90·0 : 39·0 (43%), 53·0 (59%), 22·5 (25%).

Remarks. The specimen compares closely in ornamentation and dimensions with Spath's holotype, which at 110 mm diameter has nearly half a whorl of body chamber. The Pakistani species is allied to *O. uitenhagensis* Kitchin (1908 : 206 ; pl. XI) and *O. rabei* (Besairie) (1936 : 141 ; pl. XII, figs 8, 9) but differs in being more evolute and inflated.

Locality. Makerwal in the Trans Indus Ranges.

Olcostephanus (Olcostephanus) sublaevis Spath 1939

Pl. 4, fig. 2

1939 *Olcostephanus sublaevis* Spath : 21 ; pl. III, figs 1–3 ; pl. XIX, fig. 2.

Material. Four specimens, C.79137–40.

Horizon. Upper part of the middle member of the Chichali Formation in the Trans Indus Ranges, and upper bed of the rusty brown sandstone member of the Chichali Formation at Khadimakh, Western Kohat ; Valanginian (Upper).

Description. The figured specimen is involute, inflated, semi-globular, septate and 114 mm in diameter. The whorl section is depressed and has evenly arched venter and flanks which meet the umbilical wall in a well-rounded shoulder. The umbilicus is narrow and deep, and has steep walls.

The ribs are weak and rursiradiate on the umbilical wall, and at the umbilical shoulder they swell into prominent bullae. Coming from these tubercles are bundles of 4 to 6 ribs which are prorsiradiate at first, then recurve to rectiradiate across the venter. Occasional ribs are intercalated. There is slight weakening of the ribs along the siphonal line, especially on the internal mould. Oblique constrictions bordered by flared ribs are present on outer and inner whorls. There are 20 umbilical bullae and about 96 ribs at 114 mm diameter.

Dimensions. C.79137 – 114·0 : 49·0 (43%), 76·0 (67%), 31·0 (27%).

Remarks. The figured specimen is very similar to Spath's paratype in ornamentation. The characteristic features of the species are its moderately inflated whorl section, well-rounded umbilical shoulder with high umbilical wall and bullate tubercles at the umbilical shoulder.

O. (*O.*) *sublaevis* Spath falls between species with greater whorl inflation like *O. globosus* Spath and *O. perinflatus* (Matheron), and those with more compressed whorls like *O. fascigerus* Spath and *O. radiatus* Spath. All these species occur at about the same stratigraphical level in the uppermost beds of the middle member of the Chichali Formation.

The species is reported for the first time from Western Kohat.

LOCALITIES. Punnu Mines and Lunda Mines in the Trans Indus Ranges, and south of Khadimakh in Western Kohat.

Olcostephanus (Olcostephanus) globosus Spath 1939

Pl. 4, fig. 1

1939 *Olcostephanus globosus* Spath : 16 ; pl. 5, figs 3a–b.
1972 *Olcostephanus* (*Olcostephanus*) *pachycyclus* Spath ; Fatmi : 320.

MATERIAL. Three specimens, C.79141–3.

HORIZON. Uppermost bed of the middle member of the Chichali Formation in the Trans Indus Ranges, and upper part of rusty brown sandstone member in Khadimakh ; Valanginian (Upper).

DESCRIPTION. The figured specimen is involute, globular and wholly septate. The whorl section is much depressed, with a broad arched venter which almost meets the nearly vertical umbilical wall at the rounded umbilical shoulder. The umbilicus is narrow. There are about 24 prominent, radially elongated, tubercles at the umbilical shoulder. From the tubercles bundles of 3 to 4 ribs pass across the venter transversely or with slight forward arching.

DIMENSIONS. C.79143 – 84·0 : 35·0 (42%), 70·0 (83%), 23·0 (25%).

REMARKS. The specimen compares favourably with Spath's holotype in side and ventral views and in the number of umbilical tubercles, but differs in its smaller number of bundled ribs per tubercle and less inflated shell. The bundles of 3 to 4 rectiradiate ribs and the whorl dimensions are closely comparable with those of *O. perinflatus* (Matheron), but *O. globosus* differs in its greater number of tubercles, less rapid increase of whorl breadth and greater size. The holotype of *O. perinflatus* (Matheron 1878 : pl. B20, figs 7a–b) is about 70 mm diameter and has a complete body chamber with a contracted macroconch-type mouth border, and 21 tubercles at the umbilical shoulder.

LOCALITIES. Chichali Pass in the Trans Indus Ranges and Khadimakh in Western Kohat.

Subgenus *ROGERSITES* Spath 1924

Olcostephanus (Rogersites) schenki (Oppel 1863)

Pl. 5, fig. 1

1863 *Ammonites schenki* Oppel : 286 ; pl. 81, figs 4a–c.
1903 *Holcostephanus* (*Astieria*) *schenki* (Oppel) Uhlig : 130 ; pl. XVIII, figs 2a–c.
1939 *Olcostephanus* (*Rogersites*) *schenki* (Oppel) Spath : 30 ; pl. II, fig. 6 ; pl. XVIII, figs 9–10 (with synonymy).

MATERIAL. Three specimens, C.79144–6.

HORIZON. Uppermost bed of the middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. The figured specimen is involute, inflated, 70 mm in diameter, and approximately $\frac{1}{3}$ of the outer whorl consists of body-chamber. The whorl section is depressed, the umbilicus is narrow and deep, and the umbilical wall is steep. There are about three constrictions per whorl, which are slightly more prorsiradiate than the ribs behind. The ribs on the umbilical wall are rursiradiate on the outer whorl but rectiradiate on the inner whorls, and form radially elongated tubercles on the umbilical shoulder which are sharp and conical on the inner whorl and blunt on the body-chamber. Three prorsiradiate ribs come from each tubercle and curve backwards to cross the venter radially. Occasionally ribs bifurcate higher up on the flank than the tubercles. There are 22 tubercles and 66 ribs at 70 mm diameter.

DIMENSIONS. C.79146 { 70·0 : 31·0 (44%), 42·0 (60%), 21·0 (30%).
56·0 : 25·0 (45%), 37·0 (66%), 16·0 (29%).
C.79144 – 43·0 : 19·0 (44%), 28·0 (65%), 12·0 (28%).

REMARKS. The specimens are very similar to Oppel's holotype from Tibet which was refigured and defined by Uhlig (1903). They also compare closely with Spath's figured specimen from the Trans Indus Ranges. With a complete body-chamber it is estimated that the shell reached a diameter of at least 95 to 100 mm.

LOCALITIES. Punnu Mines, Chichali Pass, Lunda Mines, Trans Indus Ranges.

Olcostephanus (Rogersites) madagascariensis Lemoine 1906

Pl. 5, figs 3, 4

1906 *Holcostephanus madagascariensis* Lemoine : 182 ; pl. 1, fig. 3.
1939 *Olcostephanus* cf. *madagascariensis* Lemoine ; Spath : 28 ; pl. XIX, fig. 3.
1962 *Olcostephanus* (*Rogersites*) *madagascariensis* Lemoine ; Collignon : pl. 82, fig. 825 (holotype refigured).

MATERIAL. Two specimens, C.79147–8.

HORIZON. Top bed of the middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. C.79147 is an adult microconch with $\frac{3}{4}$ of a whorl of body chamber ending in a constricted then flared mouth border at 64 mm diameter, on which large lateral lappets are preserved. C.79148 has a slightly shorter body chamber, the mouth border not being preserved at the broken aperture at about 71 mm diameter. Both specimens have moderately evolute and inflated shells, with depressed whorl sections. Oblique constrictions followed by a flared rib are present in both. The ribs on the umbilical wall are coarse, sharp and strongly rursiradiate in C.79147 but less strong and rectiradiate in C.79148. At the umbilical shoulder they swell into sharp tubercles. Three or four rectiradiate ribs come from each tubercle and cross the venter transversely or with slight backward arching.

There are 17 umbilical ribs and tubercles and 54 ventral ribs on C.79147 and 20 and 60 respectively on C.79148.

DIMENSIONS. C.79147 – 62·0 : 29·0 (47%), 36·0 (58%), 26·0 (42%).
C.79148 – 70·0 : 26·0 (37%), 37·0 (53%), 25·0 (36%).

Remarks. These two specimens compare very closely with the holotype as well as with Spath's figured specimen. A new varietal name is proposed for C.79148, *Olcostephanus* (*Rogersites*) *madagascariensis* var. *isakhelensis* [= *O.* (*R.*) sp. nov. of Fatmi 1972 : 320] (Pl. 5, fig. 3), which is characterized by having shorter and less rursiradiate umbilical ribs and more depressed whorls.

Localities. Chichali Pass and Lunda Mines in the Trans Indus Ranges.

Family **BERRIASELLIDAE** Spath 1922

Subfamily **BERRIASELLINAE** Spath 1922

Genus ***BERRIASELLA*** Uhlig 1905

Berriasella sp. indet.

Pl. 5, fig. 2

Material. Three specimens, C.79149–51.

Horizon. Basal 3 feet (0·9 m) of middle member of the Chichali Formation ; Berriasian.

Description. The figured specimen is a fragment of an evolute, septate whorl of about 120 mm diameter. The whorl section is higher than wide with subparallel flanks and narrow subtabulate or slightly sulcate venter. Shallow constrictions parallel to the rib direction are present. The ribs are weak on the umbilical wall, rectiradiate on the lower half of the flank, slightly prorsiradiate on the upper half of the flank, and terminate at the edge of a narrow mid-ventral smooth band in blunt tubercles which are more distinct on the inner whorls. On the larger whorls the ribs have a tendency to cross the venter with only slight degeneration and weakening. The ribs either bifurcate from the middle of the flank or remain simple, or rarely they bifucrate on the lower third of the flank.

Dimensions. C.79151 – 145·0 : 44·0 (30%), 37·0 (26%), 76·0 (52%).

Remarks. The species is characterized by having a very evolute shell and fairly widely spaced ribs that either bifurcate or remain simple. Its inclusion in *Berriasella* is favoured, rather than *Subthurmannia* to which it may be transitional. In the evolute shell and the presence of tubercles on the ventral margin it is comparable to *Subthurmannia* sp. indet. cf. *lorensis* (Lisson) figured by Spath (1939 : 55 ; pl. XII, figs 3a–b, 4 ; pl. XV, fig. 7) from the Trans Indus Salt Range. It differs, however, in the rib style and whorl section. The ribs on Spath's specimen are sharp and irregular. The ribs on the holotype of *S. lorensis* (Lisson) (1907 : 63, pl. IV, figs 4a–b, 5) are different : they are more or less rectiradiate, simple or bifurcating on the lower two-thirds of the flank, strongly projected forwards on the upper third of the whorl side, and conspicuously arched forwards, without degeneration, on the venter. It appears that both Spath's specimens from the Trans Indus Salt Range and the described specimen are different from *S. lorensis* (Lisson), and better-preserved material may show it to be a new species, transitional from *Berriasella* to *Subthurmannia*.

Localities. South-west of Malla Khel and Chichali Pass, Trans Indus Ranges.

Genus *SUBTHURMANNIA* Spath 1939

Subthurmannia fermori Spath 1939

Pl. 6, figs 1, 3 ; Pl. 7, fig. 1

1939 *Subthurmannia fermori* Spath : 53 ; pl. IX, figs 1, 5 ; pl. X, figs 1a–b, 7, 8.
1939 *Subthurmannia media* Spath : 50 ; pl. VIII, figs 1a–b.
1939 *Subthurmannia patella* Spath : 51 ; pl. VIII, figs 2a–b.

MATERIAL. Seven specimens, C.79152–8.

HORIZON. Basal 2 feet (0·6 m) of the middle member and uppermost bed of the lower member of the Chichali Formation ; Berriasian.

DESCRIPTION. All the specimens are wholly septate, the largest being 140 mm in diameter. The shell is evolute, with an elliptical whorl section, a rounded umbilical wall, and a venter that is tabulate or slightly sulcate on the inner whorls. Three types of ribs may be recognized which become more irregular and distant with increase of size. The commonest bifurcate from the blunt umbilical tubercles, and one of them commonly branches again at the middle of the flank. The second type remains simple, and the third bifurcates near the middle of whorl side, and normally both these types are without tubercles at the umbilical shoulder. The ribs are prorsiradiate on the flank and cross the venter with pronounced forward arching but with degeneration along the mid-siphonal line ; on the inner whorls the ribs are interrupted on the venter. At larger sizes the ribs become more irregular and include some intercalated ribs. There are about 11 umbilical tubercles and about 50 ribs per half whorl at 118 mm diameter.

DIMENSIONS.
C.79152 – 118·0 : 43·0 (36%), 36·0 (31%), 43·5 (37%).
C.79154 – 91·5 : 35·0 (38%), 28·0 (31%), 29·0 (32%).
C.79155 – 124·0 : 47·5 (38%), 36·0 (29%), 42·5 (34%).
C.79157 – 102·0 : 42·0 (41%), 32·0 (31%), 32·0 (31%).

REMARKS. *Subthurmannia fermori* Spath is the type species of the genus *Subthurmannia*, established by Spath (1939) from the Trans Indus Ranges. Spath erected seven new species, all of which occur at the same stratigraphic level in the basal part of the middle member and uppermost bed of the lower member of the Chichali Formation, in a total thickness of 4 to 5 feet (c. 1⅓ m). Many of his species are transitional to each other and are so closely allied that it becomes difficult to maintain their separate identity. Those named by Spath as *S. patella* and *S. media* (C.79154–5) are very similar to *S. fermori* at similar diameters in ornamentation and other details. The minor differences such as the slightly more involute, compressed shell, less sinuous and coarser ribs of *S. media* and *S. patella* (the septate holotypes are 77 and 78 mm diameter respectively, compared with the septate holotype of *S. fermori* which is 160 mm diameter) may not be sufficient to justify a specific separation when they all occur at the same stratigraphical level. Further, the differences between *S. media* and *S. patella* are smaller still. These two are, therefore, considered here to be variants of *S. fermori*. A new variant *surgharensis* (C.79157, Pl. 7, fig. 1) is proposed, which differs from the type and other variants in being more

involute, having higher whorls, a broader venter, more prominent ventral tubercles and weaker umbilical tubercles.

Subthurmannia fermori Spath is connected by various transitional fragmentary specimens in the collection with *Subthurmannia transitoria* Spath. The two, however, may be distinguished by the earlier appearance of stout, distant primary ribs and many shorter intercalatory ones in *S. transitoria*. *S. femori* also resembles *S. boissieri* (Pictet) in its large size and partly in ornamentation and whorl shape, but it is distinguished by its more rounded flank and venter at large sizes, narrower umbilicus, more pronounced forward projection of the ribs, fewer and smaller umbilical tubercles and less frequent bifurcation of the ribs on the flank.

Subthurmannia fermori and its variants are abundantly distributed in the Trans Indus Ranges and less frequently in the Samana Range in the basal part of the Cretaceous, and occupy a similar position to that of *S. boissieri* (Pictet) in Europe. The species is recorded for the first time from Western Kohat.

Localities. Many localities in the Trans Indus Salt Range, and south of Fort Lockhart in the Samana Range.

Subthurmannia filosa Spath 1939

Pl. 6, fig. 2 ; Pl. 7, fig. 3

1939 *Subthurmannia filosa* Spath : 59 ; pl. XIII, figs 5a–c.
1939 *Subthurmannia lissonioides* Spath : 52 ; pl. VIII, figs 3–4.

Material. Four specimens, C.79159–62.

Horizon. Near the contact of the middle and lower members of the Chichali Formation ; Berriasian.

Description. The figured specimens are moderately involute, have an oval whorl section and the venter is rounded, subtabulate or grooved on the inner whorls. The ribs are fine and dense, prorsiradiate and curved forwards on the upper third of the flank ; they cross the venter with strong forward arching on the outer whorl but are interrupted on the inner whorl which has a smooth siphonal groove. Bifurcation of the ribs takes place near the umbilical shoulder and again at the middle of the flank.

Dimensions. C.79160 – 77·0 : 30·5 (40%), 26·0 (34%), 25·0 (32%).
C.79162 – 70·0 : 29·5 (42%), 23·0 (33%), 20·0 (29%).

Remarks. Two finely ribbed forms of *Subthurmannia* occur in the Trans Indus Range collections at the same stratigraphic level, and Spath (1939 : 52, 59) proposed the two new species *Subthurmannia filosa* and *S. lissonioides* for them. They are very closely related and *lissonioides* is considered here to be a variety of *filosa* ; with its coarser ribs it is transitional to *S. fermori* var. *media* Spath.

In its dense ribs, less forward projection of the venter and involute shell, the figured specimens resemble *Substeueroceras kooneni* (Steuer) (1897 : pl. XVII (XXXI), figs 1–4), but they differ in having bifurcation from the umbilical shoulder or the middle of the flank. In *Substeueroceras kooneni* the point of bifurcation is usually on the lower third of the flank. The resemblance, however, indicates relationship of

the genera *Subthurmannia* and *Substeueroceras*. The species is reported for the first time from the Samana Range.

Localities. Chichali Pass, Makerwal, Punnu Mines in the Trans Indus Ranges and two doubtful specimens from the south of Fort Lockhart, Samana Range, Western Kohat.

Subthurmannia transitoria Spath 1939

Pl. 7, fig. 2 ; Pl. 10, fig. 4

1939 *Subthurmannia transitoria* Spath : 57 ; pl. XI, figs 1a, b.
1939 *Subthurmannia* sp. nov. aff. *transitoria* Spath : 58 ; pl. XI, figs 2, 3.

Material. Five specimens, C.79163–7.

Horizon. Lower 2 feet (0·6 m) of the middle member and uppermost bed of the lower member of the Chichali Formation ; Berriasian.

Description. The shell is moderately involute, the whorl section is oval and the venter is rounded at large diameters but subtabulate, tabulate or slightly sulcate at smaller diameters. The biggest specimen is still septate at 180 mm diameter. Strong, distant primary ribs are prorsiradiate to rectiradiate on the lower half of the flank but curve forwards and divide up into 2 to 4 secondary ribs on the upper part of the flank. Some of the secondaries are intercalated. The ribs cross the venter with forward arching but are weak on the mid-venter.

Dimensions. C.79163 – 180·0 : 66·0 (37%), ?51·0 (28%), ?65·0 (36%).
C.79165 – 100·0 : 43·0 (43%), 29·0 (29%), 30·0 (30%)

Remarks. The species is easily distinguishable from *Subthurmannia fermori* Spath by its coarse distant primary ribs and more irregular secondary ribs, and the whorl section tends to be more sharply convergent towards the venter.

The new variant *S. transitoria* var. *noori* (C.79165, Pl. 10, fig. 4) is similar to Spath's more involute form figured doubtfully as *S. transitoria* (1939 : pl. XI, figs 2, 3). It is more involute and has a more elevated whorl section than the holotype. *Subthurmannia transitoria* is a very commonly distributed species along with *S. fermori* in the Trans Indus Ranges.

Localities. Many localities of the Trans Indus Ranges.

Subthurmannia sp. indet.

1972 *Subthurmannia* aff. *boissieri* (Pictet) ; Fatmi : 320.
1972 *Subthurmannia* aff. *pseudopunctata* Spath ; Fatmi : 320.

Material. Nine fragments, C.79168–76.

Horizon. Lower part of the middle member and upper part of the lower member of the Chichali Formation ; Berriasian.

Remarks. There are several fragmentary specimens of the genus *Subthurmannia* which are difficult to assign to any one species due to their poor preservation. Most probably belong to *S. fermori*, *S. transitoria* or *S. filosa*, but one of them from the

Samana Range has some resemblance to *S. boissieri* Pictet. The specimens C.79175–6 resemble *Subthurmannia* (gen. nov. ?) *pseudopunctata* Spath (1939 : 61 ; pl. XIV, figs 6a–c).

Localities. Several localities in the Trans Indus Ranges and south of Fort Lockhart, Samana Range.

Genus ***PROTACANTHODISCUS*** Spath 1923

Protacanthodiscus asiaticus (Uhlig 1910)

Pl. 8, fig. 6

1910 *Hoplites* (*Acanthodiscus*) *asiaticus* Uhlig : 225 ; pl. XXIV, figs 1a–b.

Material. One specimen, C.79178.

Horizon. Near the contact of the middle and lower members of the Chichali Formation ; Berriasian.

Description. The specimen is rather evolute, septate to 120 mm diameter and the whorl section is higher than wide with a fairly broad tabulate venter. The ribs start in pairs at tubercles on the umbilical shoulder and bifurcate at tubercles in the middle of the flank. Some ribs are intercalated from about the lower or middle part of the flank, and a few ribs remain simple. There are three rows of tubercles. The tubercles near the umbilical shoulder are located on stout primary ribs from which the branching takes place. The mid-lateral row is more distantly and irregularly distributed and most ribs branch again at this row of tubercles. The small, sharp, oblique tubercles of the third row are located on each rib near the ventral margin. The ribs bend forwards on approaching the ventral margin and are much reduced on the tabulate venter.

Dimensions. C.79178 – 120·0 : 47·0 (39%), ?35·0 (29%), 43·0 (36%).

Remarks. The specimen matches Uhlig's holotype from Spiti in dimensions and ornamentation except that Uhlig's figure shows a smoother mid-ventral area. It occurs in association with *Subthurmannia*, and in whorl shape, ribbing and size it compares well with *S. fermori*, but the presence of prominent umbilical and mid-lateral tubercles and a broad tabulate venter suggests its inclusion in the genus *Protacanthodiscus*, which has similar features though the whorl section is less elevated. *Protacanthodiscus* is said to occur only in the Tithonian (Arkell *et al.* 1957 : L352) but it is interesting to note that Mazenot (1939) figured a few forms of *Berriasella* (*B. malbosi*, *B. jabronensis* and *B. isaria*) from the Berriasian, and *B. chaperi* and *B. adpera* from the Upper Tithonian of France, which appear to be better placed in *Protacanthodiscus*. The type species of *Berriasella*, *B. privasensis* (Pictet), does not have tubercles on the middle of the flank and umbilical shoulder. Similarly the type species of *Subthurmannia*, *S. fermori* Spath (1939 : pl. IX, fig. 1), does not have the mid-lateral tubercles and has a narrower venter. *Subthurmannia* is considered to be a Berriasian genus, and the occurrence of *P. asiaticus* at the same level suggests that *Protacanthodiscus* may extend up into the Berriasian.

Locality. Chichali Pass, Trans Indus Ranges.

Protacanthodiscus sp. indet.

MATERIAL. One fragment, C.79177.

HORIZON. About 3 feet (c. 1 m) below the base of the middle member of Chichali Formation ; Berriasian.

REMARKS. The specimen is poorly preserved and is recorded mainly because of its stratigraphic importance. It occurs just near the base of the *Subthurmannia* beds. It differs from most of the *Subthurmannia* species of the area in having small, prominent, sharp ventral tubercles and occasional mid-lateral and umbilical tubercles. The ribbing, however, differs little from the genus *Subthurmannia*.

In side view and ornamentation it is comparable with *Berriasella parahimouna* Mazenot (1939 : 92 ; pl. XII, figs 2a–b), but differs in having a wider whorl section. It also resembles *Protacanthodiscus andreai* (Kilian) (Mazenot 1939 : pl. XII, figs 1a–b) but differs in details of ornamentation.

Mazenot assigned a Berriasian age to *B. parahimouna*, whose generic affinities appear to be closer to *Protacanthodiscus* than to *Berriasella* as it shows irregular lateral and umbilical tubercles, a feature typical of *Protacanthodiscus*.

LOCALITY. Lunda Mines, Trans Indus Ranges.

Subfamily **NEOCOMITINAE** Spath 1924

Genus ***THURMANNICERAS*** Cossmann 1901

Thurmanniceras sp. indet. 1

Pl. 10, fig. 1

MATERIAL. Three fragments, C.79179–81.

HORIZON. 4 feet (1·22 m) above the base of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. The specimen consists of a septate fragment which has a whorl height of 46 mm and whorl breadth of 40 mm. The whorl section is subrectangular with flattened flanks and a broad, tabulate, and slightly sulcate venter. The ribs are slightly sinuous, prorsiradiate and weak near the middle of the flank. Some of the ribs bifurcate from the umbilical bullae and occasionally branch again at the middle of the flank. In addition there are ribs which bifurcate at the middle of the flank only, or are intercalated and start at the middle of the flank. All the ribs are strong on the ventral–lateral shoulder, where they swell into small transversely elongated tubercles, but they are weakened or interrupted on the mid-ventral area. Shallow constrictions parallel to the rib direction are present.

REMARKS. Spath (1939 : 81 ; pl. X, fig. 6) figured the ventral view of a specimen from the Trans Indus Salt Range and doubtfully assigned it to *Thurmannites* (?) sp. indet. cf. *pronecostatus* (Felix). The present specimen is similar but has more flattened flanks and a broader venter. In its broad flat venter it compares with *T. umbilicocostatum* (Collignon 1962 : 195 ; fig. 894) but differs in having fewer and more prominent umbilical tubercles. The suture line is complex and is comparable

with that of *Hoplites* (*Neocomites*) *scientychus* Uhlig (1902 : pl. 5, fig. 1a) which probably belongs to *Thurmanniceras* rather than *Neocomites*.

LOCALITY. South-west of Malla Khel, Trans Indus Ranges.

Thurmanniceras sp. indet. 2

MATERIAL. Four fragments, C.79182–5.

HORIZON. 5 to 6 feet (c. 1⅔ m) above the base of the middle member of the Chichali Formation ; Valanginian (Lower).

REMARKS. The largest fragment is septate and has a whorl height of 50 mm and a whorl breadth of 34 mm. The whorl section is subrectangular, much higher than wide, with nearly flat flanks and a tabulate or slightly rounded venter.

The species is more compressed than *Thurmanniceras* sp. indet. 1, above. It resembles Spath's (1939 : 87 ; pl. XXII, figs 11a–b) *Neocomites* aff. *neocomiensiformis* (Uhlig), from the Trans Indus Salt Range, in ventral view. It is characterized by its large size (as is also *N.* aff. *neocomiensiformis*), compressed whorls, rather weak ribs and oblique blunt tubercles (similar to *Kilianella*) on the ventral shoulder. Incorporating characters of *Neocomites*, *Thurmanniceras* and *Kilianella* it appears to be a transitional form.

LOCALITIES. Chichali Pass, Trans Indus Ranges and south of Fort Lockhart, Samana Range, Western Kohat.

Genus ***NEOCOMITES*** Uhlig 1905

Subgenus ***NEOCOMITES*** Uhlig 1905

Neocomites (Neocomites) copei sp. nov.

Pl. 8, fig. 1

HOLOTYPE. C.79186, the only specimen.

HORIZON. 7 feet (2·13 m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DIAGNOSIS. Involute, compressed, whorl section, subrectangular with gently arched flanks and tabulate to slightly sulcate venter ; umbilicus very narrow, with vertical umbilical wall and angled umbilical shoulder ; 3 or 4 shallow constrictions, 32 primary ribs and 14 umbilical tubercles at 55 mm diameter.

DESCRIPTION. The specimen is 55 mm in diameter and septate, though the beginning of the body-chamber may be present. The whorl section is compressed and much higher than wide. The flanks are arched and converge towards a narrow tabulate or very gently sulcate venter.

The ribs are prominent on the inner whorl but become weaker on the outer whorl ; they are sinuous, prorsiradiate, and projected forwards on the upper third of the flank, and they usually bifurcate on the middle or upper part of the flank. There are small tubercles at the umbilical shoulder from which the ribs start in pairs, and

another row of small tubercles at the ventral termination of all the ribs. The mid-ventral area is smooth. There are shallow sinuous constructions parallel to the rib direction.

DIMENSIONS. C.79186–55·5 : 29·0 (52%), 16·5 (30%), 9·0 (16%).

REMARKS. The species resembles *Neocomites* (*N.*) *neocomiensis* var. *subtenuis* Sayn (1907 : 30 ; pl. 5, fig. 5) but differs in having stronger umbilical tubercles. It may also be compared with *N.* (*N.*) *paraplesius* (Uhlig 1902 : 59 ; pl. 11, fig. 8) but differs in being more compressed and in having stronger umbilical tubercles.

LOCALITY. South-west of Malla Khel, Trans Indus Ranges.

Neocomites (Neocomites) sp. indet.

1972 *Neocomites* (*Calliptychoceras*) spp. nov. Fatmi : 319.

MATERIAL. Three fragments, C.79187–9.

HORIZON. 6 to 7 feet (c. 2 m) below the top of middle member of Chichali Formation ; Valanginian (Lower).

REMARKS. The fragments are poorly preserved and may belong to more than one species of *Neocomites*. The ribbing and whorl section suggest affinities with *N.* (*N.*) *teschenensis* (Uhlig), *N.* (*N.*) *campylotoxus* (Uhlig) or *N.* (*N.*) *copei* sp. nov.

LOCALITIES. Chichali Pass, Lunda Mines, north of Kalabagh, Trans Indus Ranges.

Neocomites (Neocomites) campylotoxus (Uhlig 1902)

Pl. 8, figs 3, 4

1902 *Hoplites campylotoxus* Uhlig : 49 ; pl. 4, figs 1–3.
1972 *Kilianella* sp. nov. Fatmi : 319–20, 362.

MATERIAL. Three specimens, C.79190–2.

HORIZON. 6 feet (1·83 m) below the top of middle member of Chichali Formation in the Trans Indus Ranges and middle part of rusty brown sandstone member at Khadimakh ; Valanginian (Lower).

DESCRIPTION. The figured specimen is moderately evolute, compressed and about 55 mm in diameter. The last septum occurs at a diameter of 45 mm. The whorl section is elliptical with arched flanks and a narrow tabulate–sulcate venter. The ribs are sinuous on the outer whorl but straighter on the inner whorls. Most of them are single and only occasional ribs bifurcate at the middle of the flank. They swell near the ventral shoulder into oblique tubercles and the mid-ventral area appears to be smooth.

DIMENSIONS. C.79191 – 45·0 : 18·0 (40%), ?11·0 (24%), 15·5 (34%).

REMARKS. The figured specimen compares closely with Uhlig's holotype. In ribbing and tuberculation it is also comparable with *Kilianella pexiptycha* (Uhlig) and *K. leptosma* (Uhlig), but differs in being less evolute and lacking constrictions.

The specimen C.79192 is more evolute and has a less elevated whorl section but the ribbing style is very similar.

Localities. Samana Range, Khadimakh in Western Kohat and Chichali Pass in the Trans Indus Ranges.

Neocomites (Neocomites) pycnoptychus (Uhlig 1910)

Pl. 8, fig. 2

1910 *Hoplites* (*Neocomites*) *pycnoptychus* Uhlig : 252 ; pl. LXXXVII, figs 1a–c.

Material. Three specimens, C.79193–5.

Horizon. 6 to 7 feet (c. 2 m) below the top of middle member of the Chichali Formation ; Valanginian (Lower).

Description. The figured specimen is wholly septate, the whorl section is subrectangular, higher than wide, the flanks are gently arched and converge towards a fairly broad, tabulate to slightly sulcate venter. The ribs are sinuous and prorsiradiate ; they swell into tubercles at the umbilical shoulder and show slight swelling into incipient tubercles at the ventral shoulder. Ribs commonly bifurcate from the umbilical tubercles and one or both ribs branch again near the middle of the flank. All the ribs are interrupted on the slightly sulcate, smooth venter.

Dimensions. C.79193 – 63·0 : 26·0 (41%), 21·0 (33%), 20·5 (33%).

Remarks. The figured specimen is similar to Uhlig's original specimen from Lochambelkichak, Spiti area. Uhlig's specimen shows the beginning of the body-chamber at the aperture at 56·5 mm diameter. The species is recorded for the first time from the Trans Indus Ranges.

Localities. South-west of Malla Khel, and one doubtful specimen from Makerwal, Trans Indus Ranges.

Neocomites (Neocomites) similis Spath 1939

Pl. 8, figs 5, 7 ; Pl. 9, figs 1, 3

1939 *Neocomites similis* Spath : 83 ; pl. XI, figs 5a–b.
1972 *Neocomites* (*Odontodiscoceras*) *similis* Spath ; Fatmi : 319.

Material. Ten specimens, C.79196–205.

Horizon. 4 to 5 feet (c. 1⅓ m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

Description. The shell is involute, compressed on the inner whorls but more inflated on the body-chamber. The whorl section is tall and compressed, with an inclined umbilical wall and a tabulate venter. On the body-chamber the middle of the venter tends to be raised. The ornament consists of primary, secondary and intercalated ribs which are prorsiradiate and sinuous on the flanks and are more strongly projected forwards on approaching the venter. They swell into oblique tubercles at the edge of the venter and form weak, forwardly-directed chevrons on

the venter, especially on the body-chamber, but are interrupted along the mid-ventral line. There are moderately strong tubercles at the umbilical shoulder. The ribs bifurcate and trifurcate irregularly on the lower half of the flank. Some ribs remain simple and many secondary ribs are intercalated at the middle of the flank. There are 21 primary ribs with umbilical tubercles at 56 mm diameter and 24 at 36 mm diameter. The rib density increases on the inner whorls.

DIMENSIONS. C.79196 – 56·0 : 26·5 (47%), 17·0 (30%), 12·5 (22%).
C.79197 – 36·0 : 17·0 (47%), 11·0 (31%), 8·0 (22%).
C.79198 – 43·0 : 20·0 (47%), 13·0 (30%), 10·0 (23%).
C.79203 – 77·0 : 33·0 (44%), ? 19·0 (24%).

REMARKS. The figured specimens are similar to Spath's holotype but are more complete and better preserved. One of them (C.79197) shows part of the body-chamber with strong ribbing and tuberculation and a more inflated whorl section. In whorl section and amount of involution of the inner septate whorls the species is comparable with *Neocomites neocomiensis* (d'Orbigny), but differs in ornament details and in having an inclined rather than vertical umbilical wall. *N. neocomiensis* (d'Orbigny) has sheaves of 4 ribs from the umbilical tubercles, while in *N. similis* (Spath) the ribs branch more commonly from the lower half of the flank rather than from the umbilical tubercles, and they are more strongly projected.

The species is much more closely comparable with *Neocomites* (? *Odontodiscoceras*) *montanus* (Uhlig) and *N.* (? *O.*) *indomontanus* (Uhlig 1910 : 249 ; pl. XC, figs 1, 3, 5, 7) in ornament, whorl section and size, but differs in having stronger prorsiradiate ribs, somewhat different rib bifurcation on the inner whorls and less prominent umbilical and ventral tubercles.

Spath (1939 : 91) favoured the inclusion of *N. montanus* in the subgenus *Odontodiscoceras*, and indeed the ribs (and those of *N. similis* Spath) show stronger resemblance on outer whorls to those of the subgenus *Odontodiscoceras* rather than the true *Neocomites*. The inner whorls, however, are closer to *Neocomites*. The clavi-like tubercles on the ventral shoulder and the forward extension of ribs on the venter as weak chevrons, especially on the body-chamber, are characters of *Lyticoceras*. *Neocomites similis* Spath and *N. montanus* (Uhlig) might be intermediate forms which connect *Neocomites* with *Odontodiscoceras* and *Lyticoceras*. The *Lyticoceras* venter and *Odontodiscoceras* ribbing appear on the outer whorl, while the inner whorls are more like true *Neocomites*.

LOCALITIES. Chichali Pass, Trans Indus Ranges.

Neocomites (Neocomites) trezanensis Sayn 1907

Pl. 9, fig. 4

1907 *Neocomites trezanensis* Sayn : 34 ; pl. 3, figs 20, 25 ; pl. 4, fig. 5.

MATERIAL. Two specimens, C.79206–7.

HORIZON. 5 feet (1½ m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. The figured specimen is septate to 40 mm diameter, then has a short fragment of body-chamber. The whorl section is higher than wide, and the flanks converge towards a sulcate venter. There are 6 to 7 moderately deep sinuous constrictions per whorl running parallel to the rib direction. The ribs are strong, prorsiradiate and slightly sinuous, and many bifurcate from prominent umbilical tubercles and branch again on the middle of the flank. Some ribs are without tubercles at the umbilical shoulder and either bifurcate on the middle of the flank or remain simple. All the ribs terminate at the ventral shoulder in sharp oblique tubercles and the venter is smooth and sulcate.

DIMENSIONS. C.79206 – 40·0 : 17·5 (44%), ?14·0 (35%), 12·0 (30%).

REMARKS. The figured specimen is very similar to Sayn's holotype except that in the holotype the constrictions are less prominent. It may be compared to *N.* (*Calliptychoceras*) *calliptychus* (Uhlig 1910 : 251 ; pl. LXXXVII, figs 2a–c) from Lochambelkichak, Spiti, in ornament and whorl section but differs in its smaller size, steeper umbilical wall, prominent and frequent constrictions bordered by thick blunt ventral clavi, fewer umbilical tubercles and less sinuous, forwardly-projected ribs on the flank.

LOCALITIES. Punnu Mines, north of Kalabagh, Trans Indus Ranges.

Subgenus ***PARANDICERAS*** Spath 1939

Neocomites (Parandiceras) rota (Spath 1939)

Pl. 9, figs 2, 5

1939 *Parandiceras rota* Spath : 77 ; pl. XV, figs 1a–b.
1972 *Neocomites* (*Parandiceras*) *theodorii* (Oppel) ; Fatmi : 319, 362.
1972 *Neocomites* (*Parandiceras*) aff. *indicus* (Uhlig) ; Fatmi : 319.

MATERIAL. Six specimens, C.79208–13.

HORIZON. 4 to 5 feet (c. 1⅓ m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. The shell is moderately evolute. The whorl section is higher than wide, wedge-shaped on the outer whorls but more compressed on inner whorls, and converges towards a narrow, tabulate or sulcate venter. There are shallow constrictions parallel to the ribs. The ribs are straight and prorsiradiate on the flanks, and commonly bifurcate on the middle or lower part of the flank. There are occasional simple ribs and some which bifurcate at the umbilical shoulder, especially on the inner whorls. The ribs swell into small tubercles on the umbilical shoulder and end in prominent tubercles at the edge of the venter, which are oblique and extend onto the sides of the venter.

DIMENSIONS. C.79208 – 48·0 : 21·0 (44%), 15·0 (31%), 12·0 (5%).

REMARKS. Spath's genus *Parandiceras* (with type species *Parandiceras rota* Spath) is considered to be a subgenus of *Neocomites* because (1) *Parandiceras* occurs in the Lower Valanginian alongside typical *Neocomites*, (2) the inner whorls of *Parandiceras* show frequent bifurcation from the umbilical shoulder like that of

Neocomites, and (3) *P. rota* is connected with *Neocomites* through intermediate forms like *Neocomites theodorii* (Oppel) (Uhlig 1910 : 260 ; pl. LXXXIX, figs 1a–d, 2a–b) and *N. indicus* (Uhlig), which have simple and bifurcating ribs on the outer whorl but have more double bifurcating ribs, of the *Neocomites* type, on the inner whorls, and a more involute shell. The umbilical tubercles are small, like *Neocomites*, but the ventral tubercles are strong, as in *Calliptychoceras*. The venter is narrower and the ventral shoulder more angular than in *Calliptychoceras* and *Odontodiscoceras*.

It is probable that several offshoots of *Neocomites* appeared during the Lower Valanginian. The *Odontodiscoceras* trend is marked by greater inflation of the whorl, a wider umbilicus, stronger umbilical and ventral tubercles, and bifurcation and trifurcation of the ribs on the flank. In the *Parandiceras* trend the shell becomes more evolute and less compressed, the venter becomes narrower, the ribs mainly bifurcate at the middle of the flank and there are some intercalated ribs. The umbilical tubercles become weaker and the ventral tubercles stronger. In the *Calliptychoceras* trend the shell is more evolute, the whorl section more inflated, the umbilical and ventral tubercles are stronger and the sulcate venter is moderately broad. *Neocomites* itself persisted from the Berriasian to the Valanginian and is characterized by its compressed, involute shell, subrectangular whorl section, narrow umbilicus, small umbilical and ventral tubercles, and branching of the ribs from the umbilical tubercles shoulder and branching again at the middle of the flank.

It appears that during the Lower Valanginian large species of *Neocomites* appeared, with coarser, sinuous ribs (*N. teschenensis*, *N. platycostatus* and *N. neocomensiformis*), and with a more evolute shell and greater projection of the ribs on the venter they gave rise to the genus *Lyticoceras* during Upper Valanginian times. The very interesting species described here, *N.* (*N.*) *similis* Spath (p. 280), shows typical *Neocomites* ribbing and whorl shape on the inner whorls and *Odontodiscoceras* ribbing and whorl shape on the outer whorl. It has a tendency to oblique tuberculation and forward projection of the ribs on the venter of the outer whorl like that of *Lyticoceras*, which occurs at a higher level in the Upper Valanginian *Olcostephanus* and *Rogersites* beds of the Trans Indus Ranges.

It is concluded, therefore, that *Calliptychoceras*, *Odontodiscoceras* and *Parandiceras* may best be regarded as subgenera of *Neocomites* on the basis of their similar stratigraphic position in the Lower Valanginian and some common characteristics suggesting a close ancestry.

Localities. South-west of Malla Khel, Chichali Pass, in the Trans Indus Ranges.

Genus ***LYTICOCERAS*** Hyatt 1900

Subgenus ***BESAIRIECERAS*** Collignon 1962

Lyticoceras (Besairieceras) colcanapi (Collignon 1962)

Pl. 9, fig. 6 ; Pl. 10, fig. 3

1962 *Besairieceras colcanapi* Collignon : 58 ; pl. 196, fig. 899 ; pl. 197, fig. 900.

MATERIAL. Six specimens, C.79214–9.

HORIZON. Upper part of the middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. One of the figured specimens (Pl. 10, fig. 3) is 95 mm in diameter and has nearly a quarter whorl of body-chamber, while the other (Pl. 9, fig. 6) has nearly half a whorl of body-chamber. The whorls are evolute, the whorl section is subrectangular and the venter is subtabulate on the outer whorls but sulcate on the inner whorls. Fairly deep constrictions on the inner whorls become shallow, then disappear on the outer whorl. The ribs are slightly sinuous and prorsiradiate but are more strongly projected forwards near the ventral shoulder where they swell into weak tubercles. Ribs bifurcate from the umbilical shoulder, and sometimes again in the middle of the flank. The ribs form forwardly-directed chevrons on the venter, and border a mid-ventral smooth band on the outer whorl and a sulcus on the inner whorls. Umbilical tubercles appear at about 50 mm diameter and become prominent and sharp at larger sizes.

DIMENSIONS. C.79214 – 95·0 : 39·0 (41%), 27·0 (28%), 35·0 (37%).
C.79216 – 66·0 : 24·0 (36%), 20·0 (30%), 24·0 (36%).

REMARKS. One of the figured specimens (Pl. 10, fig. 3) is very similar to Collignon's holotype from the Upper Valanginian of Madagascar. In Pakistan the genus occurs in the *Olcostephanus* and *Rogersites* beds, also of Upper Valanginian age. Collignon created the genus *Besairieceras* for ammonites which develop large inwardly-pointing tubercles on the umbilical edge but are otherwise very similar to *Lyticoceras*. These Pakistan specimens show the commencement of the umbilical tubercles and are referred, therefore, to *Besairieceras*, which is considered here to be a subgenus of *Lyticoceras*. The fragmentary specimen from the Trans Indus Salt Range described by Spath (1939 : 90 ; pl. XVIII, figs 5a–b) as *N.* (? *Lyticoceras*) sp. nov. is very similar but has stronger forwards projection of the ribs of the venter, and is rather more involute.

LOCALITIES. Malla Khel, Lunda Mines, Trans Indus Ranges, and upper part of rusty brown sandstone member in Khadimakh, Western Kohat.

Lyticoceras (Besairieceras) planecostatum (Collignon 1962)

Pl. 10, fig. 5

1962 *Besairieceras planecostatum* Collignon : pl. 198, fig. 903.

MATERIAL. Two specimens, C.79220–1.

HORIZON. Upper part of middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. The figured specimen is part of a body-chamber with a whorl height of 39 mm and a whorl breadth of 25 mm. The whorl section is rectangular, with flat flanks and a fairly broad tabulate venter. The ribs are prorsiradiate, strongly sinuous and forwardly projected at the ventral shoulder. They cross the

venter with much weakening along the slightly raised mid-ventral line. The ribs commonly bifurcate from blunt umbilical tubercles, and occasionally bifurcate again about the middle of the flank. The ribs swell into oblique tubercles at the ventral shoulder.

Remarks. The species differs from *Lyticoceras* (*B.*) *colcanapi* (Collignon) in its strongly sinuous ribs, its larger swelling at the edge of the venter and the larger chevrons on the venter.

Localities. South of Fort Lockhart, Samana Range, Western Kohat and Punnu Mines, Chichali Pass, Malla Khel, Trans Indus Ranges.

Genus ***NEOCOSMOCERAS*** Blanchet 1922

Neocosmoceras octagonum (Blanford 1864)

Pl. 10, fig. 2

1864 *Ammonites octagonus* (Strachey MS) Blanford : 128 ; pl. 1, figs 5a–c.
1910 *Hoplites* (*Acanthodiscus*) *octagonus* (Strachey) ; Uhlig : 204 ; pl. XXII, figs 1a–c ; pl. XIX, figs 1a–b ; pl. XX, figs 1a–b, 2 ; pl. XXVI, figs 3a–c (with synonymy).
1939 *Neocosmoceras octagonum* (Strachey MS) Blanford sp. ; Spath : 71.

Material. Two specimens, C.79222–3.

Horizon. Upper part of the lower member of the Chichali Formation ; Berriasian.

Description. Both specimens are fragments ; the larger one is part of a shell about 100 mm in diameter. The whorl section is octagonal and the venter is slightly sulcate. The ornament consists of coarse, distant ribs which are prorsiradiate on the flank and mainly simple, but occasionally bifurcate. They are surmounted by umbilical, lateral and ventrolateral tubercles, of which the latter are the most prominently elevated and bullate. The umbilical tubercles are weak and are occasionally represented only by a rib swelling. The ribs do not cross the smooth, slightly sulcate venter.

Remarks. The figured specimen is very similar in ornament and whorl shape to Uhlig's figure of *N. octagonum* from the Upper and Middle Spiti shales. Blanford's (1864) original figured specimen, however, has a body-chamber at a much smaller size, and is fragmentary. The present specimen differs in having weaker umbilical tubercles and a slightly broader venter, and may constitute a variety. It is also closely comparable with *N. octagonoides* (Uhlig 1910 : pl. XXVII, figs 1a–b, 2a–b) which, in fact, is very similar to *N. octagonum*. Among the European species, it is fairly close to *N. rerollei* (Paquier 1900 : pl. VII, fig. 3) and its subspecies *lamberti* Kilian as figured in Mazenot (1939 : pl. XXIX, figs 5–6). It differs, however, in having a wider whorl section.

In the Samana Range, the species occurs just below the *Subthurmannia* bed, near the Jurassic/Cretaceous boundary.

Locality. South of Fort Lockhart, Samana Range, Western Kohat.

Neocosmoceras sp. indet.

MATERIAL. One fragment, C.79224.

HORIZON. Basal part of the middle member of the Chichali Formation ; Berriasian.

REMARKS. This is a poorly preserved, wholly septate, quarter whorl fragment at about 150 mm shell diameter, which shows considerable resemblance to the holotype of *Neocosmoceras spitiensis* (Uhlig 1910 : 221 ; pl. XXVI, figs 2a–c) from Lochambelkichak, Spiti. However, it is rather more evolute and has a narrower venter than Uhlig's specimen.

LOCALITY. Punnu Mines, Trans Indus Ranges.

? *Neocosmoceras subradiatum* (Uhlig)

Pl. 10, fig. 6

1910 *Hoplites* (*Acanthodiscus*) *subradiatus* Uhlig : 208 ; pl. XXIII, figs 1a–b ; pl. XXVI, fig. 1.
1933 *Octagoniceras subradiatus* (Uhlig) ; Spath : 804.

MATERIAL. Three fragments, C.79225–7.

HORIZON. Near the contact of the lower and middle members of the Chichali Formation, in the Trans Indus Ranges, and 5 feet (1½ m) above the base of the Chichali Formation at Kala Chitta ; Berriasian.

DESCRIPTION. The three fragmentary specimens display evolute octagonal whorls in which the whorl breadth exceeds the whorl height. The primary ribs are hardly more than swellings between the large umbilical and lateral bullae. Secondary ribs extend from the lateral bullae to the ventral shoulder and onto the side of the venter. At the ventral shoulder they are raised into oblique tubercles. The ribs on the side of the venter are inclined slightly forwards and are interrupted along the siphonal line.

REMARKS. These fragments are similar to Uhlig's holotype from the Spiti area. The weak ventral tubercles and extension of the ribs onto the venter are features not usually found in *Neocosmoceras*, and perhaps the species may constitute a new subgenus. It is possible that *Neocosmoceras* evolved from the Tithonian genus *Protacanthodiscus*, which gave rise to two distinct forms : the true *Neocosmoceras* (*N. sayni*) developed strong ventral clavi, while in *N. subradiatum* ventral clavi or tubercles are weak or absent.

LOCALITIES. Punnu Mines, Trans Indus Ranges and west of Ghoramar, Kala Chitta Range.

Genus *KILIANELLA* Uhlig 1905

Kilianella asiatica Spath 1939

Pl. 11, figs 1, 5

1910 *Hoplites* (*Kilianella*) *pexiptychus* Uhlig : 229 ; pl. LXXXII, figs 2a–c.
1939 *Kilianella asiatica* Spath : 93 ; pl. XIV, figs 2a–b.

MATERIAL. Five specimens, C.79228–32.

HORIZON. 4 to 6 feet (1·2–1·8 m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. The whorls are evolute, the whorl section is subquadrate, higher than wide, and the venter is tabulate and has a mid-ventral sulcus. The ribs are strong, sharp and sinuous, and are projected well forwards at the ventral shoulder and on the sides of the venter but are interrupted at the smooth, narrow mid-venter. Some ribs bifurcate from the umbilical shoulder and again at the middle of the flank, and occasional ribs are simple. The bifurcation point on the middle of the flank is sometimes raised into small tubercles which are distinct on the outer whorl but are less prominent on the inner whorls. The ribs are also slightly swollen at the ventro-lateral edge.

DIMENSIONS. C.79228 – 42·0 : 16·7 (40%), 15·0 (36%), 15·5 (37%).

REMARKS. The specimen described from the Spiti area as *K. pexiptycha* (Uhlig 1910 : pl. LXXXII, figs 2a–c) closely resembles *K. asiatica* and differs significantly from the true *K. pexiptycha* (Uhlig), as was pointed out by Spath (1939 : 94). Both the Spiti and Trans Indus specimens of *Kilianella asiatica* differ from the original of *K. pexiptycha* in having very sinuous, sharp ribs, no constrictions, a more inflated whorl section, more simple ribs and less prominent ventral clavi. Uhlig (1910 : 229) pointed out the indistinct nature or absence of constrictions and greater sinuosity of the ribs of his Spiti specimen but considered it to belong to *K. pexiptycha* because a great deal of variation existed in this group. Uhlig's Spiti specimen has more pronounced ventral swellings and less sinuous ribs than the Trans Indus specimens but it appears to be closer to *K. asiatica* than to *K. pexiptycha* which has denser ribs.

LOCALITY. Chichali Pass, Punnu Mines, Trans Indus Ranges.

Kilianella cf. ***besairiei*** Spath 1939

Pl. 11, fig. 3

1939 *Kilianella besairiei* Spath : 26 ; pl. XVI, figs 4a–b, 5a–c.

MATERIAL. Two specimens, C.79233–4.

HORIZON. About 7 feet (2 m) below the top of the middle member of Chichali Formation ; Valanginian (Lower).

DESCRIPTION. The figured specimen is a fragment of a body-chamber, with a quadrilateral whorl section which narrows to a fairly broad venter that is sulcate due to thick bordering clavi. The ribs are coarse, strongly sinuous, both simple and bifurcating, and they swell into thick blunt oblique tubercles on the ventral shoulder and are interrupted along the middle of the venter.

REMARKS. These specimens strongly resemble the body-chamber fragment figured by Spath (1939 : pl. XVI, figs 5a–c) from the Lower Neocomian of Madagascar but differ in having more frequent bifurcation from the middle of the flank.

LOCALITY. Chichali Pass, Trans Indus Ranges.

Genus *DISTOLOCERAS* Hyatt 1900

Distoloceras sp. indet.

Pl. 11, fig. 2

MATERIAL. One specimen, C.79235.

HORIZON. 6 feet (1·83 m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. This specimen is evolute, wholly septate and 61 mm in diameter. The whorl section is compressed, elliptical with a narrow tabulate venter and a rounded umbilical edge. The ribs are prorsiradiate on the flank and curve strongly forwards near the venter. They are mainly single but some bifurcate from the umbilical shoulder or in the middle of the flank. On the outer whorl there are some intercalated ribs. On the venter the ribs are weaker, and they are interrupted at the mid-venter. Fairly strong tubercles occur on every second or third rib just ventral of the mid-lateral joint and also at the edge of the venter. The ribs in between are either non-tuberculate or bear much smaller lateral and ventral tubercles.

DIMENSIONS. C.79235 – 61·0 : 25·5 (42%), 20·0 (33%), 21·0 (34%).

REMARKS. This specimen is too small to show the uncoiling stage exhibited by some species of *Distoloceras*. Its morphological characters agree with that genus, though the ribs are somewhat finer and the tubercles smaller than in either *D. hystrix* (Phillips) or *D. pavlovi* Spath (Wright 1957 : 360, figs 472, 473). Its Lower Valanginian age in Pakistan may indicate that it is transitional between *Neocomites* or *Kilianella* and the true *Distoloceras*, which occurs mainly in the Lower Hauterivian.

LOCALITY. South-west of Malla Khel, Trans Indus Ranges.

Distoloceras sp. indet.

Pl. 11, fig. 4

MATERIAL. Two fragments, C.79236–7.

HORIZON. Upper 2 feet (0·61 m) of the middle member of the Chichali Formation ; Valanginian (Upper).

REMARKS. These two fragments do not differ in any respect from similar-sized parts of the more complete Lower Valanginian specimen of Pl. 11, fig. 2. They do not, therefore, require separate description. Both of them are fragments of immature body-chambers of 45 to 50 mm diameter. They probably represent an early species of *Distoloceras*.

LOCALITIES. South-west of Malla Khel and Lunda Mines, Trans Indus Ranges.

Genus *SARASINELLA* Uhlig 1905

Sarasinella uhligi Spath 1939

Pl. 12, fig. 2

1939 *Sarasinella uhligi* Spath : 99 ; pl. XII, fig. 5 ; pl. XIV, figs 1a, b ; pl. XXI, figs 5a–b, 6.

MATERIAL. Three specimens, C.79238–40.

HORIZON. 8 feet (2·4 m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. All the specimens are septate fragments of fairly involute, moderately compressed whorls, with quadrate whorl sections, in which the flat flanks are convergent towards a fairly broad, tabulate or slightly sulcate venter. The ribs are moderately dense and rectiradiate and curve slightly forwards near the venter. They bifurcate from the umbilical tubercles and again in the middle of the flank, and they pass onto the sides of the venter but are interrupted in the middle. There are a few shallow constrictions parallel to the ribs. There are small tubercles at the umbilical edge, and the ribs are raised into small, blunt, elongated tubercles at the ventral shoulder. There are poorly preserved traces of mid-lateral tubercles on the smallest whorls.

DIMENSIONS. C.79240 – 67·0 : 30·5 (46%), 23·0 (34%), 18·5 (28%).

REMARKS. The figured specimen is probably closer to the specimen figured as var. *elegans* Spath (1939 : pl. XXI, figs 5a, b) than to the holotype of *S. uhligi* which has fewer ribs.

LOCALITY. Makerwal, Trans Indus Salt Ranges.

Sarasinella sp. indet.

MATERIAL. One fragment, C.79241.

HORIZON. 7 feet (2·1 m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

REMARKS. This fragmentary specimen is recorded because of its stratigraphic importance. It differs from *S. uhligi* in having stronger ribs, a lower bifurcation point on the flank and more prominent constrictions. Both the umbilical and ventrolateral tubercles are also stronger. It appears to be close to *Sarasinella chichalensis* Spath (1939 : pl. XXI, figs 3, 4).

LOCALITY. Chichali Pass, Trans Indus Ranges.

Sarasinella cf. ***subspinosa*** (Uhlig 1910)

Pl. 11, fig. 7

1910 *Hoplites* (*Sarasinella*) *subspinosus* Uhlig : 239 ; pl. XC, figs 4a–c.

MATERIAL. One specimen, C.79242.

HORIZON. 8 to 10 feet (c. $2\frac{3}{4}$ m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

REMARKS. This fragment differs from *S. uhligi* Spath in possessing prominent mid-lateral bullate tubercles on every third or fourth rib, and in being more evolute. The lateral tubercles appear to become weaker on the largest part of the specimen

preserved, which has a diameter of about 55 mm. In these characters it agrees with *S. subspinosa*, and differs from the specimens of *S. uhligi* described above.

LOCALITY. Lunda Mines, Trans Indus Ranges.

Genus ***LEOPOLDIA*** Mayer-Eymar 1887

Leopoldia sp. indet.

Pl. 11, fig. 8

MATERIAL. Two specimens, C.79243–4.

HORIZON. Upper bed of the middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. The larger of these two fragmentary specimens is wholly septate and 92 mm in diameter. The whorls are involute and compressed, and the convex flanks converge towards a narrow, tabulate venter. The ribs are weak or absent on most of the flank but they occur on the umbilical edge and are stronger on the ventral shoulder where they are prorsiradiate and swell into blunt tubercles. The middle of the venter is smooth. On the inner whorls the ventral tubercles are more prominent.

REMARKS. The specimen compares favourably with *L. leopoldi* (d'Orbigny) in its involute shell, whorl section and ornament, but differs in having less pronounced umbilical and ventral tubercles.

LOCALITIES. North-west of Malla Khel, Punnu Mines in the Trans Indus Ranges.

Genus ***NEOHOPLOCERAS*** Spath 1939

Neohoploceras baumbergeri Spath 1939

Pl. 12, fig. 3

1939 *Neohoploceras baumbergeri* Spath : 106 ; pl. XXII, figs 3a–b.
1962 *Neohoploceras besairiei* Collignon : pl. 192, fig. 875.

MATERIAL. Two specimens, C.79245–6.

HORIZON. 5 to 6 feet (c. $1\frac{2}{3}$ m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

DESCRIPTION. Both specimens are 85 to 90 mm in diameter and wholly septate. The whorls are evolute and the whorl section is polygonal (hexagonal or octagonal), depressed, and has a tabulate and sulcate venter. The ribs are strong, rectiradiate on the flank, strongly projected over the ventral shoulder, and form forwardly-directed chevrons on the venter but are interrupted along the siphonal line. Every second or third rib bears a small umbilical tubercle, a large and prominent lateral tubercle and a weak swelling at the ventral shoulder. The intermediate ribs do not have umbilical or lateral tubercles but have slight swellings at the ventral shoulder. Some ribs bifurcate at the lateral tubercles. Constrictions are probably present on the inner whorl but are poorly preserved.

Remarks. The figured specimen is similar in dimensions and other details to Spath's holotype. It is characterized by the forward projection of the ribs on the venter, lack of constrictions on the outer whorl and prominent thick bullae at the middle of the flank. Spath included the species in *Neohoploceras*, but the projection of the ribs on the venter and the lack of constrictions on the outer whorl is unlike the type species *Neohoploceras submartini* (Mallada) or the other *Neohoploceras* species Spath described (1939 : pl. XVII, figs 8a–c ; pl. XV, figs 10a–d ; pl. XXI, figs 8a–b) from the Trans Indus Ranges.

Locality. South-west of Malla Khel, Trans Indus Ranges.

Neohoploceras submartini (Mallada 1882)

Pl. 11, fig. 6

1882 *Ammonites submartini* Mallada : pl. X, figs 7–9 ; pl. XI, figs 12–14.
1939 *Neohoploceras submartini* (Mallada) Spath : 105 ; pl. XVI, figs 1a–d (with synonymy).
1962 *Neohoploceras submartini* (Mallada) ; Collignon : pl. 192, fig. 872.

Material. One complete specimen, C.79247, and one fragment, C.79248.

Horizon. 4 to 5 feet (c. 1⅓ m) below the top of the middle member of the Chichali Formation ; Valanginian (Lower).

Description. The complete specimen is involute, moderately inflated and wholly septate. The flanks are arched and the venter is fairly narrow and grooved. Three constrictions parallel to the ribs and bordered on the umbilical shoulder by stronger tubercles are present on the outer whorl.

The ribs are fairly strong and rectiradiate, and they commonly bifurcate from prominent umbilical tubercles and bifurcate again at about the middle of the flank. Occasional ribs do not have umbilical tubercles and either remain simple or bifurcate at the middle of the flank. All the ribs terminate on the ventral shoulder in small incipient tubercles. There are four constrictions on the outer whorl, parallel to the ribs, and the rib behind each one has a much larger tubercle on the ventral shoulder.

Dimensions. C.79247 – 46·5 : 21·0 (45%), 19·0 (41%), 11·0 (24%).

Remarks. The figured specimen compares well in ribbing and constrictions with Spath's (1939) and Collignon's (1962) figures, except that the mid-lateral tubercles are not developed.

Locality. Makerwal, Trans Indus Ranges.

Neohoploceras collignoni sp. nov.

Pl. 12, fig. 1

Diagnosis. Moderately large evolute form, with a polygonal whorl section and a tabulate to sulcate venter ; mid-lateral and ventral bullate tubercles, strong ribs that commonly bifurcate from the middle of flank, but occasionally remain simple, and some intercalated ribs ; deep constrictions.

Holotype. C.79249, the only specimen.

STRATIGRAPHIC RANGE. Upper part of middle member of the Chichali Formation ; Valanginian (Upper).

DESCRIPTION. The inner whorls are depressed and have a grooved venter. They have ribs that become thick and have flat tops on the upper half of the flanks and the ventral shoulder where they terminate in square-topped bullae. Lateral bullae also occur near the middle of the flank and prominent deep constrictions are present. Half of the outer whorl is body-chamber which is massive, but more compressed than the inner whorl. The ribs are strong, fairly widely spread and either simple or bifurcate at the middle of the flank, and there are many intercalated ribs. The lateral tubercles are much smaller than on the inner whorl but the bullae bordering the sulcate venter remain strong and are present on every rib. There is a tendency for blunt tubercles to develop at the umbilical edge. Deep constrictions are present on the outer whorl.

DIMENSIONS. C.79249 – 167·0 : 60·0 (36%), 61·0 (37%), 62·0 (37%).

REMARKS. The new species may be distinguished from other species of the genus by its large size, whorl shape, irregular thick and flat-topped ribs, and prominent lateral and ventral tubercles.

LOCALITY. South-west of Malla Khel, Trans Indus Ranges.

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VI. INDEX

New taxonomic names and the page numbers of the principal references are printed in **bold** type. An asterisk (*) denotes a figure.

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PLATE 1

All figures natural size

Neolissoceras grasianum (d'Orbigny) (p. 263)

FIGS 1a, 1b. Berriasian. Malla Khel, Trans Indus Range. C.79101.
FIGS 2a, 2b. Berriasian. Punnu Mines, Trans Indus Range. C.79102.

Spiticeras (Spiticeras) mojsvari (Uhlig) (p. 264)

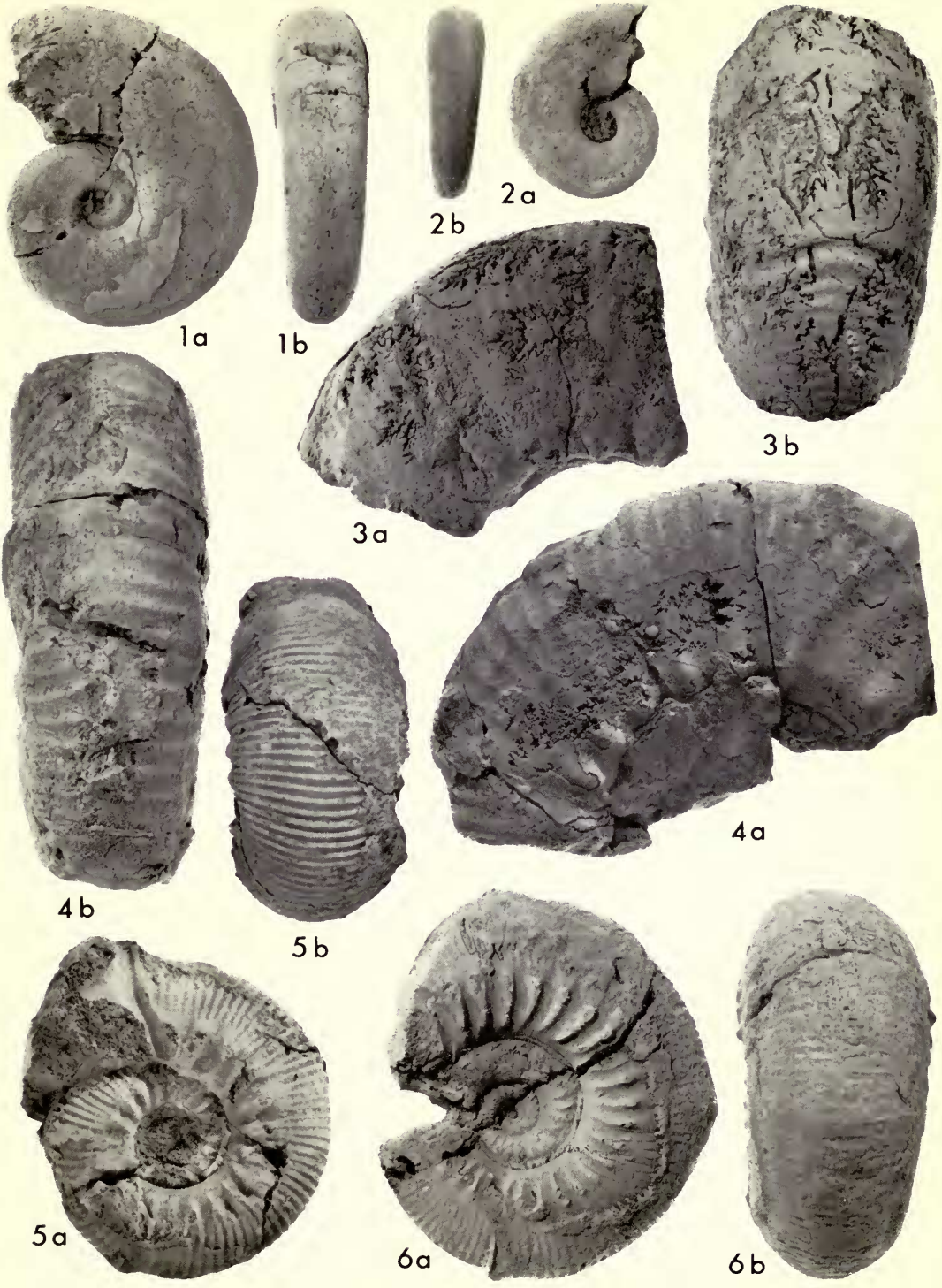
FIGS 3a, 3b. Berriasian. Khadimakh (south flank), Kohat district. C.79107.

Spiticeras (Spiticeras) cf. ***griesbachi*** (Uhlig) (p. 264)

FIGS 4a, 4b. Berriasian. South of Fort Lockhart, Samana Range. C.79106.

Olcostephanus (Olcostephanus) salinarius Spath
(p. 266 ; see also Pl. 2, fig. 4 and Pl. 3, fig. 1)

FIGS 5a, 5b. Valanginian. Lunda Mines, Trans Indus Range. C.79117.
FIGS 6a, 6b. Valanginian. Chichali Pass, Trans Indus Range. C.79111.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2b
2a
3b
3a
4b
5b
4a
5a
6a
6b

PLATE 2

Olcostephanus (Olcostephanus) sakalavensis (Besairie)
(p. 267 ; see also Pl. 3, fig. 2 and Pl. 4, fig. 3)

FIGS 1a, 1b. U. Valanginian. Chichali Pass, Trans Indus Range. C.79126, × 1·0.
FIGS 3a, 3b. U. Valanginian. Khadimakh, Kohat district. C.79131, × 1·0.

Spiticeras (Negreliceras) tenuicostatum Djanélidzé (p. 265)

FIGS 2a, 2b. Berriasian. SW of Malla Khel, Trans Indus Range. C.79108, × 0·6.

Olcostephanus (Olcostephanus) salinarius Spath
(p. 266 ; see also Pl. 1, figs 5, 6 and Pl. 3, fig. 1)

FIGS 4a, 4b. Valanginian. Makerwal, Trans Indus Range. C.79120, × 1·0.

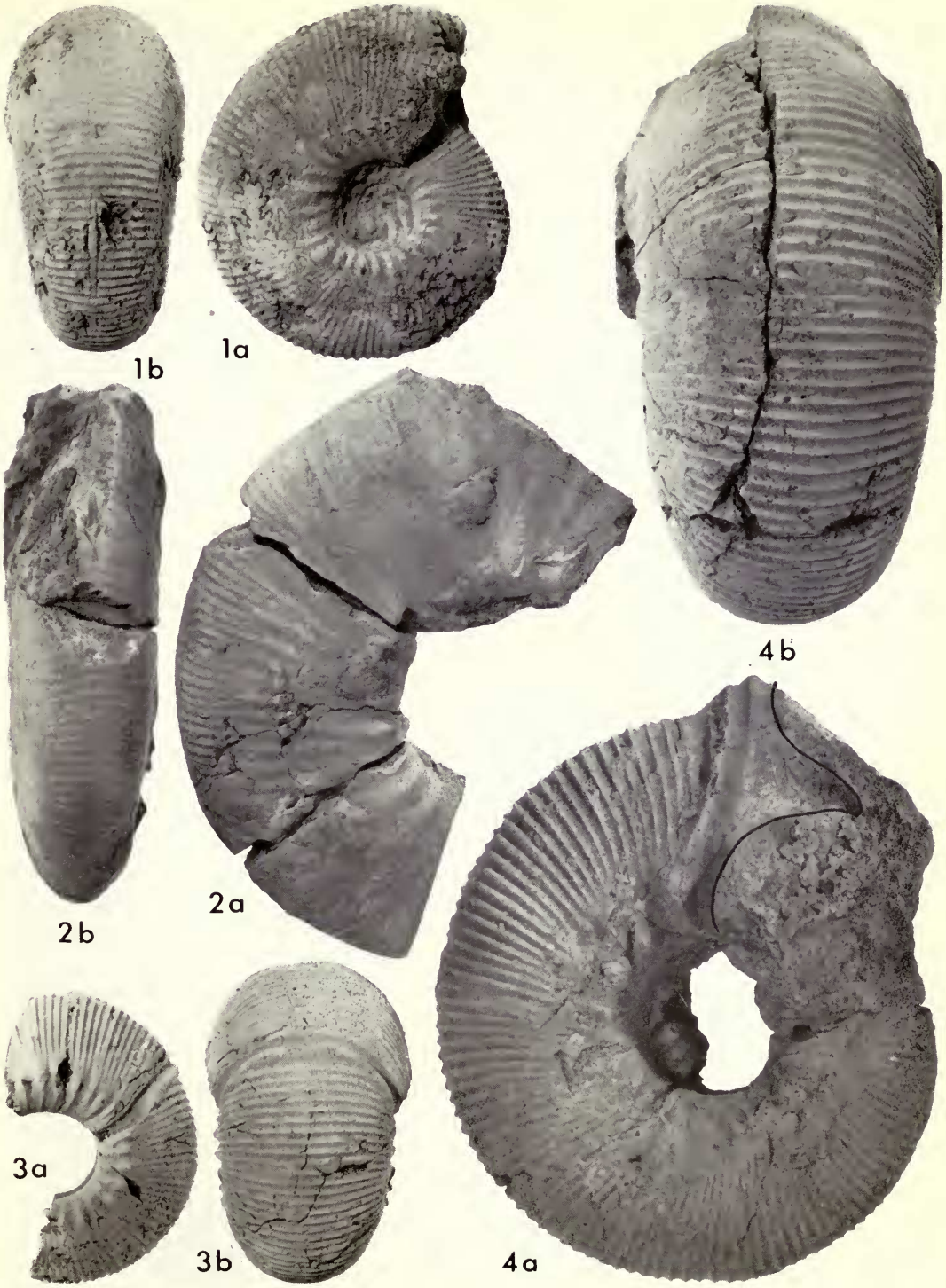

1b
1a
4b
2b
2a
3a
3b
4a

PLATE 3

All figures natural size

Olcostephanus (Olcostephanus) salinarius Spath
(p. 266 ; see also Pl. 1, figs 5, 6 and Pl. 2, fig. 4)

FIGS 1a, 1b. Valanginian. Malla Khel, Trans Indus Range. C.79118.

Olcostephanus (Olcostephanus) sakalavensis (Besairie)
(p. 267 ; see also Pl. 2, figs 1, 2 and Pl. 4, fig. 3)

FIGS 2a, 2b. U. Valanginian. Makerwal, Trans Indus Range. C.79132.

Olcostephanus (Olcostephanus) fascigerus Spath (p. 268)

FIGS 3a, 3b. U. Valanginian. Makerwal, Trans Indus Range. C.79136.

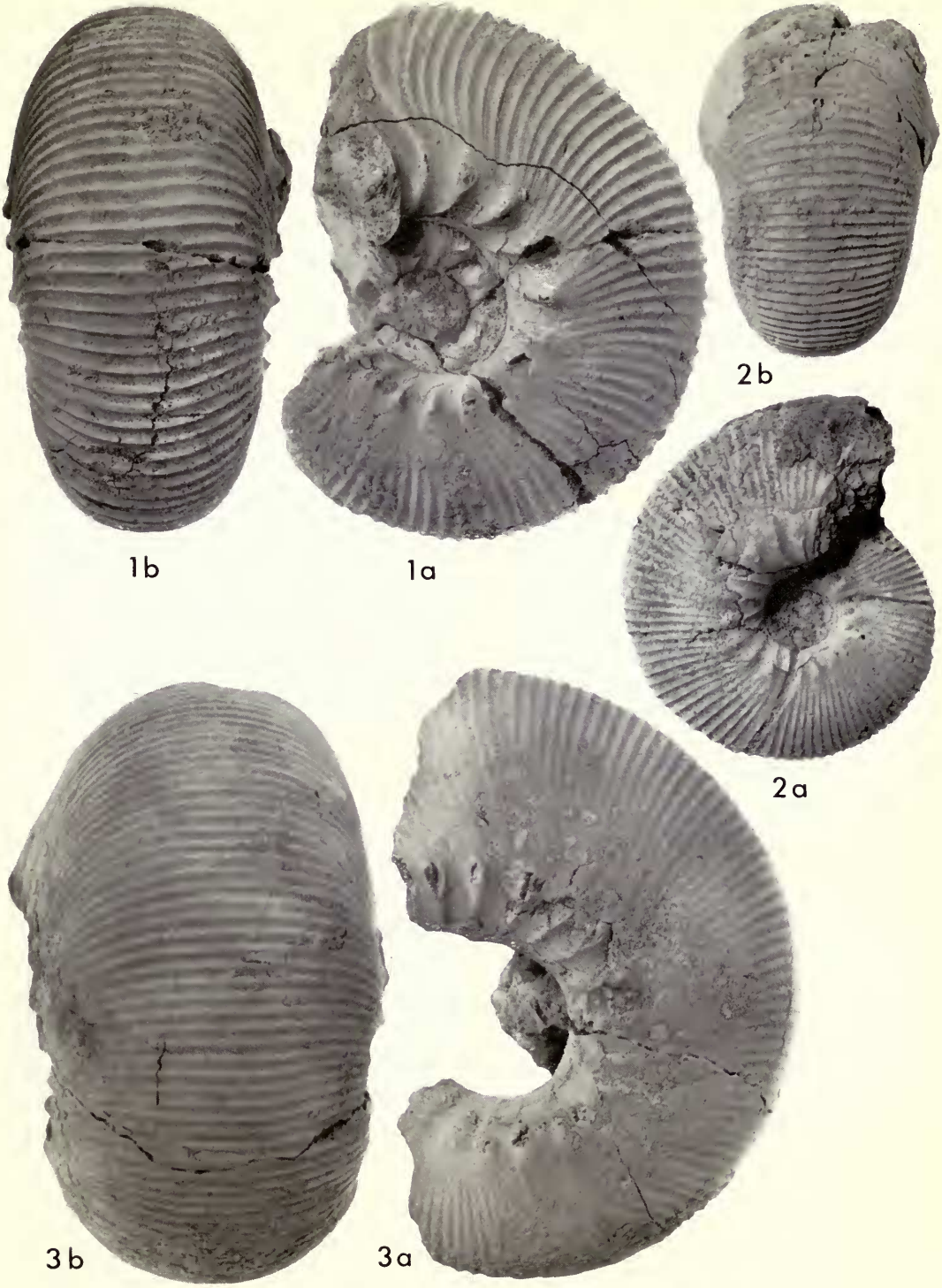

1b
1a
2b
2a
3b
3a

PLATE 4

Olcostephanus (Olcostephanus) globosus Spath (p. 270)

FIGS 1a, 1b. U. Valanginian. Chichali Pass, Trans Indus Range. C.79143, ×0·8.

Olcostephanus (Olcostephanus) sublaevis Spath (p. 269)

FIGS 2a, 2b. U. Valanginian. Punnu Mines, Trans Indus Range. C.79137, ×0·58.

Olcostephanus (Olcostephanus) sakalavensis (Besairie)
(p. 267 ; see also Pl. 2, figs 1, 3 and Pl. 3, fig. 2)

FIGS 3a, 3b. U. Valanginian. SW of Malla Khel, Trans Indus Range. C.79127, × 0·8.

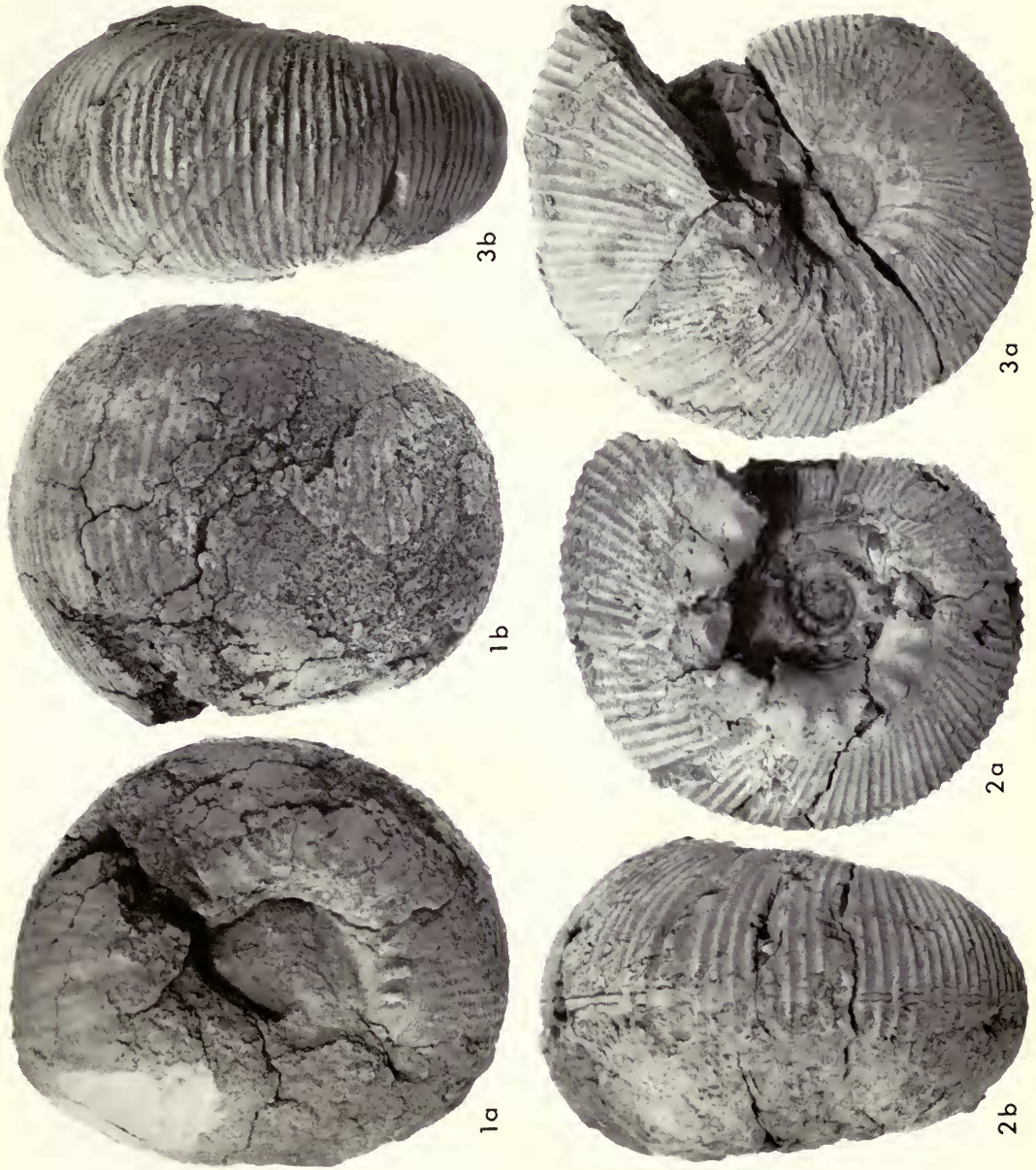

3b
3a
1b
2a
1a
2b

PLATE 5

All figures natural size

Olcostephanus (Rogersites) schenki (Oppel) (p. 270)

FIGS 1a, 1b. U. Valanginian. Punnu Mines, Trans Indus Range. C.79146.

Berriasella sp. indet. (p. 272)

FIGS 2a, 2b. Berriasian. SW of Malla Khel, Trans Indus Range. C.79151.

Olcostephanus (Rogersites) madagascariensis Lemoine var. ***isakhelensis*** nov. (p. 272)

FIGS 3a, 3b. U. Valanginian. Lunda Mines, Trans Indus Range. C.79148.

Olcostephanus (Rogersites) madagascariensis Lemoine (p. 271)

FIGS 4a, 4b. U. Valanginian. Lunda Mines, Trans Indus Range. C.79147.

1b

1a

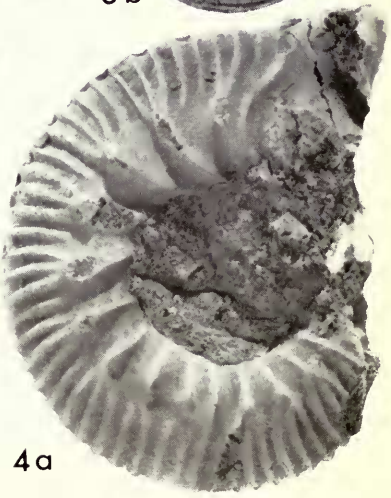
4b

2a

3b

2b

3a



4a

PLATE 6

Subthurmannia fermori Spath (p. 273 ; see also Pl. 7, fig. 1)

Figs 1a, 1b ; 3a, 3b. Berriasian. Chichali Pass, Trans Indus Range. Figs 1, C.79152, × 0·75. Figs 3, C.79154, × 1·0.

Subthurmannia filosa Spath (p. 274 ; see also Pl. 7, fig. 3)

Figs 2a, 2b. Berriasian. Chichali Pass, Trans Indus Range. C.79160, × 1·0.

1b

1a

2a

3a

3b

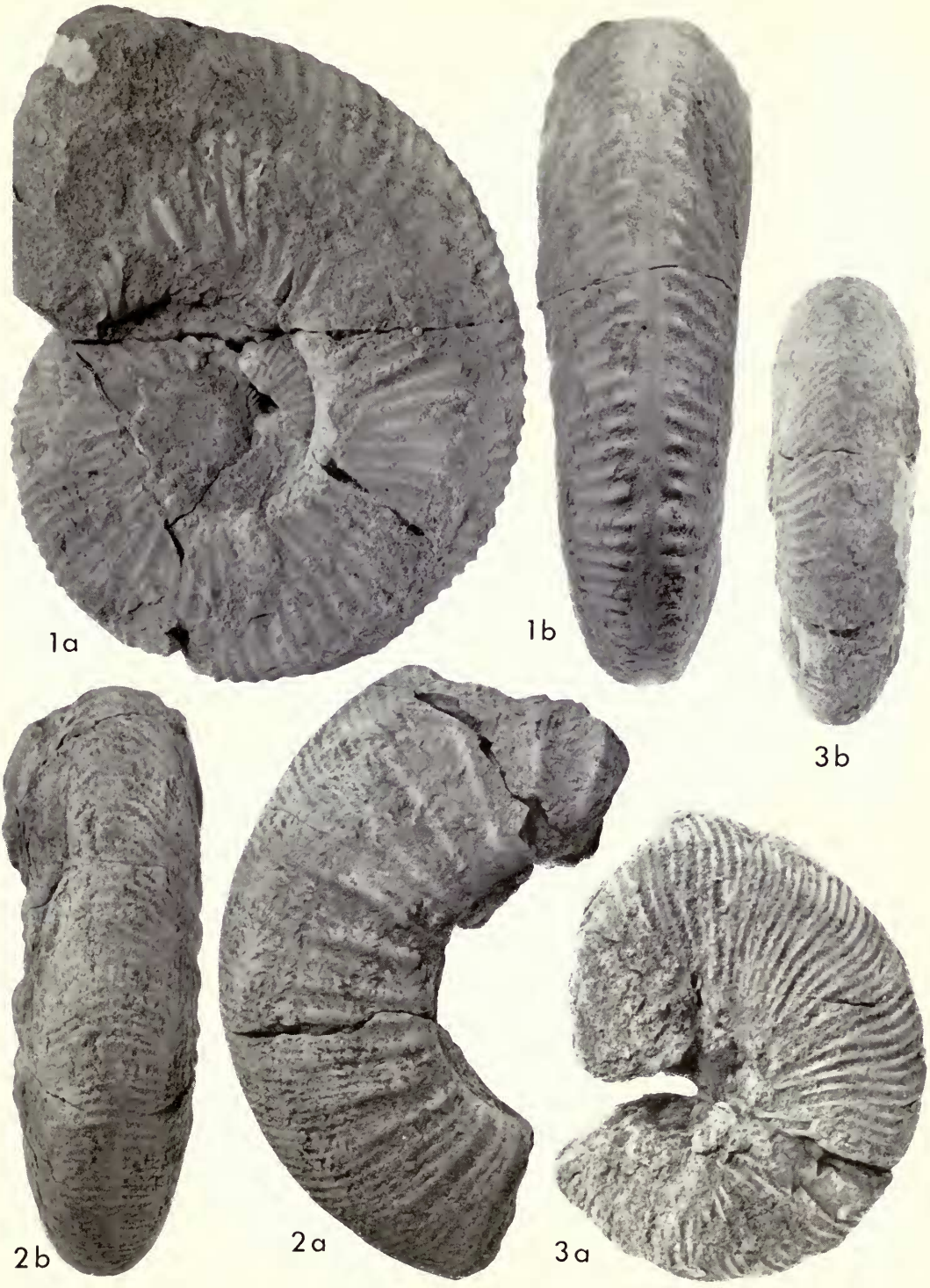
2b

PLATE 7

Subthurmannia fermori Spath var. ***surgharensis*** nov.
(p. 273 ; see also Pl. 6, fig. 1)
FIGS 1a, 1b. Berriasian. SW of Malla Khel, Trans Indus Range. C.79157, ×1·0.

Subthurmannia transitoria Spath (p. 275 ; see also Pl. 10, fig. 4)
FIGS 2a, 2b. Berriasian. Chichali Pass, Trans Indus Range. C.79163, ×0·6.

Subthurmannia filosa Spath (p. 274 ; see also Pl. 6, fig. 2)
FIGS 3a, 3b. Berriasian. Chichali Pass, Trans Indus Range. C.79162, ×1·0.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3b
2b
2a
3a

PLATE 8

Neocomites (Neocomites) copei sp. nov. (p. 278)

FIGS 1a, 1b. L. Valanginian. Lunda Mines, Trans Indus Range. C.79186, holotype, × 1·0.

Neocomites (Neocomites) pycnoptychus (Uhlig) (p. 280)

FIGS 2a, 2b. L. Valanginian. SW of Malla Khel, Trans Indus Range. C.79193, × 1·0.

Neocomites (Neocomites) campylotoxus (Uhlig) (p. 279)

FIG. 3. L. Valanginian. Chichali Pass, Trans Indus Range. C.79190, × 1·0.

FIG. 4. L. Valanginian. Khadimakh, Kohat district. C.79191, × 1·0.

Neocomites (Neocomites) similis Spath (p. 280 ; see also Pl. 9, figs 1, 3)

FIGS 5a, 5b, 7a, 7b. L. Valanginian. Chichali Pass, Trans Indus Range. Figs 5, C.79196, × 1·0. Figs 7, C.79198, × 1·0.

Protacanthodiscus asiaticus (Uhlig) (p. 276)

FIGS 6a, 6b. Berriasian. Chichali Pass, Trans Indus Range. C.79178, × 0·7.

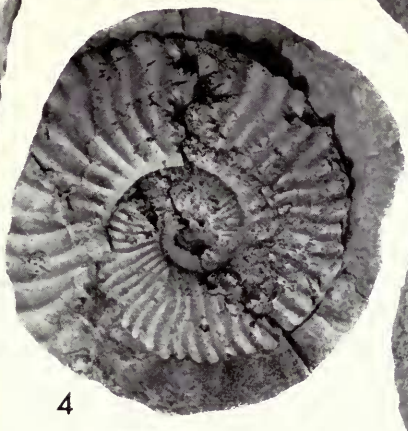
1b

1a

2a

2b

3



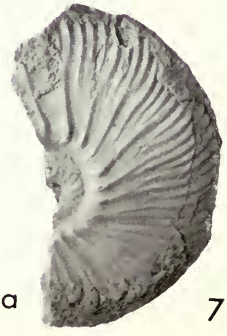
4

5a

5b

6b

6a



7a

7b

PLATE 9

All figures natural size

Neocomites (Neocomites) similis Spath (p. 280 ; see also Pl. 8, figs 5, 7)

Figs 1a, 1b, 3a, 3b. L. Valanginian. Chichali Pass, Trans Indus Range. Figs 1, C.79197. Figs 3, C.79203.

Neocomites (Parandiceras) rota Spath (p. 282)

Figs 2a, 2b. L. Valanginian. SW of Malla Khel, Trans Indus Range. C.79208.

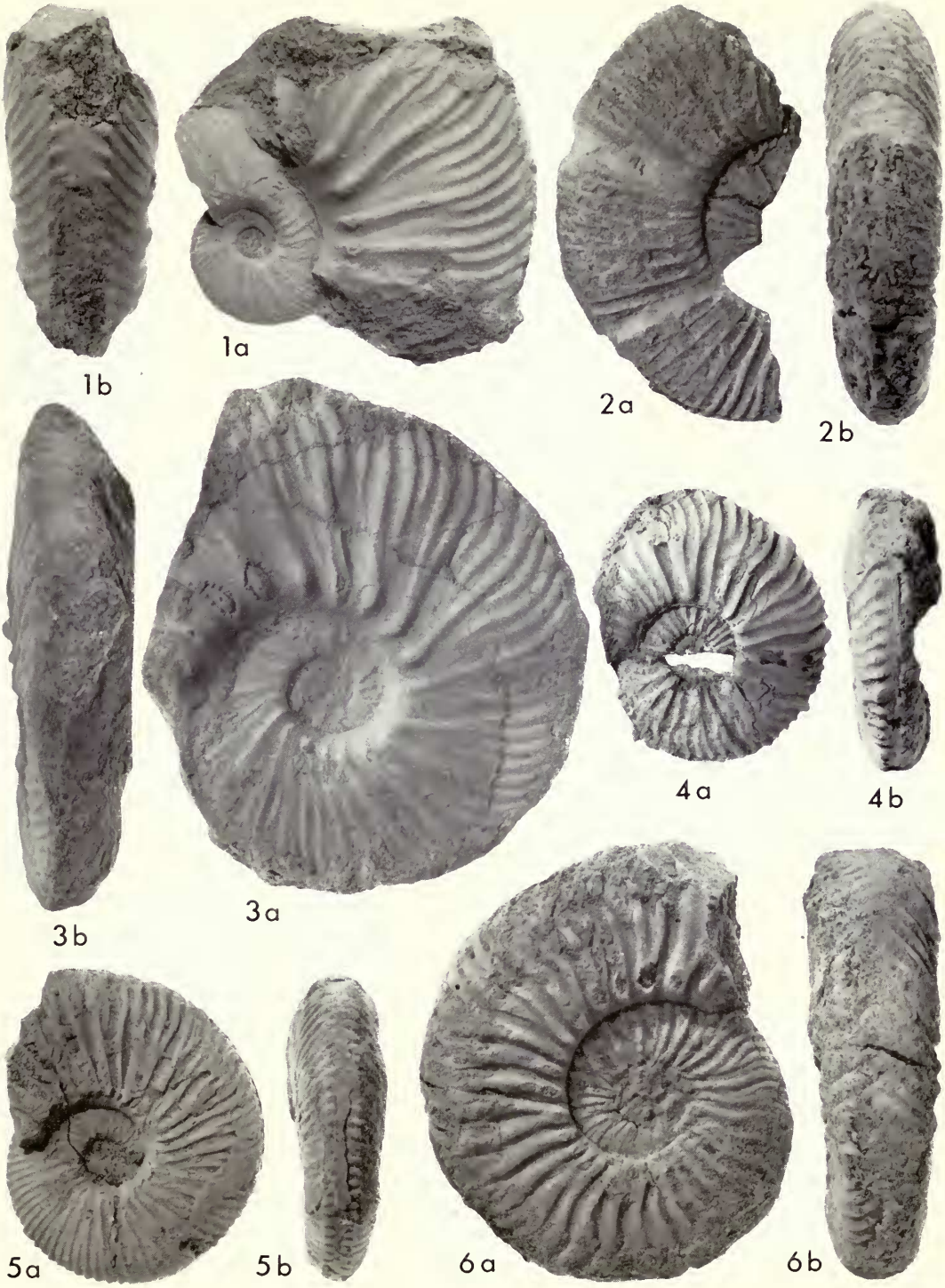
Figs 5a, 5b. L. Valanginian. Makerwal, Trans Indus Range. C.79209.

Neocomites (Neocomites) trezanensis Sayn (p. 281)

Figs 4a, 4b. L. Valanginian. Punnu Mines, Trans Indus Range. C.79206.

Lyticoceras (Besairieceras) colcanapi (Collignon) (p. 283 ; see also Pl. 10, fig. 3)

Figs. 6a, 6b. U. Valanginian. Lunda Mines, Trans Indus Range. C.79216.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6a
6b

PLATE 10

All figures × 0·7

Thurmanniceras sp. indet. 1 (p. 277)

FIGS 1a, 1b. L. Valanginian. SW of Malla Khel, Trans Indus Range. C.79179.

Neocosmoceras octagonum (Blanford) (p. 288)

FIGS 2a, 2b. Berriasian. South of Fort Lockhart, Samana Range, Western Kohat. C.79222.

Lyticoceras (Besairieceras) colcanapi (Collignon)
(p. 283 ; see also Pl. 9, fig. 6)

FIGS 3a, 3b. U. Valanginian. Malla Khel, Trans Indus Range. C.79214.

Subthurmannia transitoria Spath var. ***noori*** nov.
(p. 275 ; see also Pl. 7, fig. 2)

FIGS 4a, 4b. Berriasian. Chichali Pass, Trans Indus Range. C.79165.

Lyticoceras (Besairieceras) planecostatum (Collignon) (p. 284)

FIGS 5a, 5b. U. Valanginian. Malla Khel, Trans Indus Range. C.79220.

? Neocosmoceras subradiatum (Uhlig) (p. 286)

FIGS 6a, 6b. Berriasian. Punnu Mines, Trans Indus Range. C.79225.

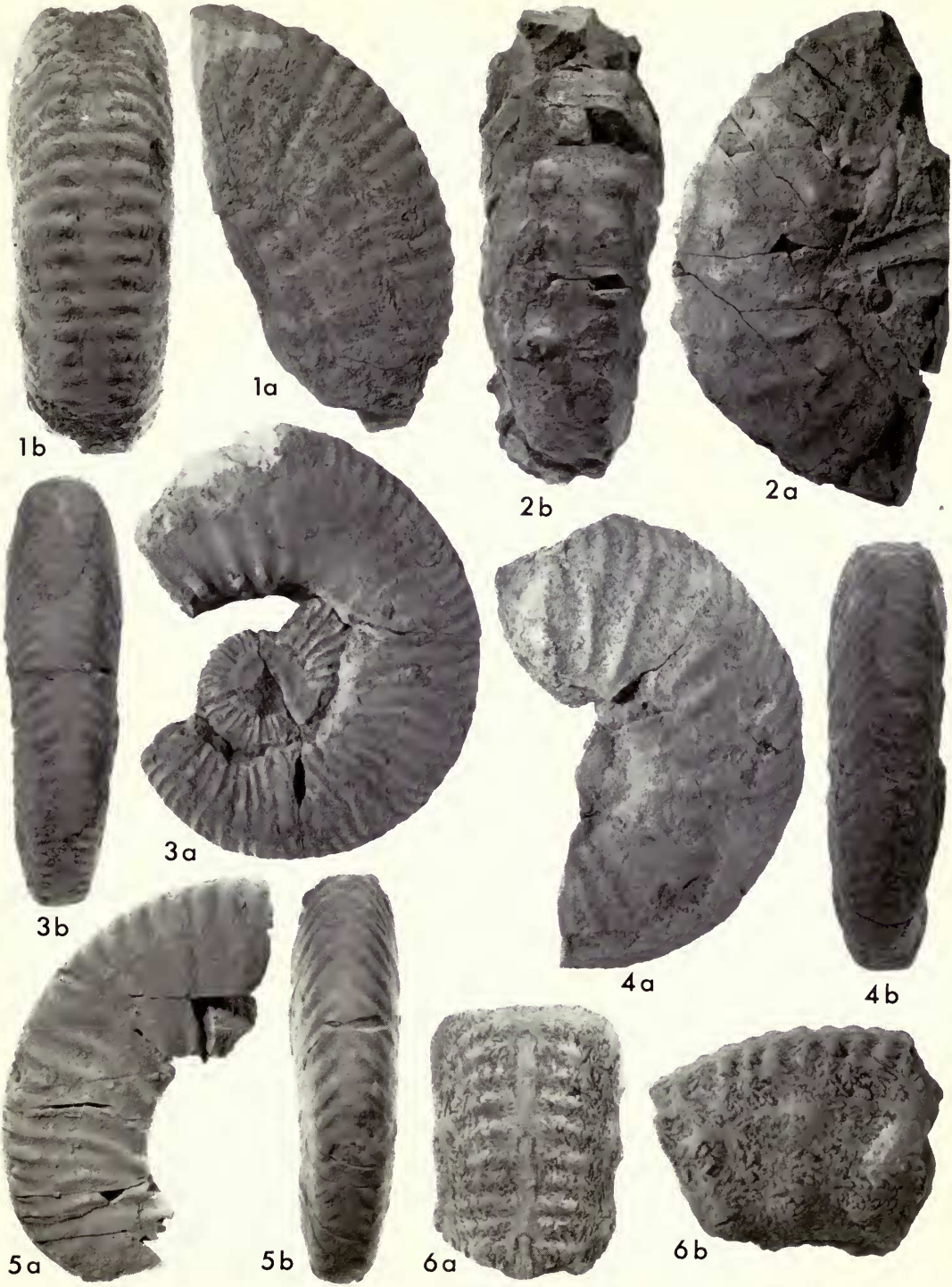

1a
1b
2b
2a
3a
3b
4a
4b
5a
5b
6a
6b

PLATE 11

All figures natural size

Kilianella asiatica Spath (p. 286)

Figs 1a, 1b, 5a, 5b. L. Valanginian. Chichali Pass, Trans Indus Range. Figs 1, C.79228. Figs 5, C.79232.

Distoloceras sp. indet. (p. 288)

Figs 2a, 2b. L. Valanginian. SW of Malla Khel, Trans Indus Range. C.79235.

Figs 4a, 4b. U. Valanginian. SW of Malla Khel, Trans Indus Range. C.79236.

Kilianella cf. ***besairiei*** Spath (p. 287)

Figs 3a, 3b. L. Valanginian. Chichali Pass, Trans Indus Range. C.79233.

Neohoploceras submartini (Mallada) (p. 291)

Figs 6a, 6b. L. Valanginian. Makerwal, Trans Indus Range. C.79247.

Sarasinella cf. ***subspinosa*** (Uhlig) (p. 289)

Figs 7a, 7b. L. Valanginian. Lunda Mines, Trans Indus Range. C.79242.

Leopoldia sp. indet. (p. 290)

Figs 8a, 8b. U. Valanginian. NW of Malla Khel, Trans Indus Range. C.79243.

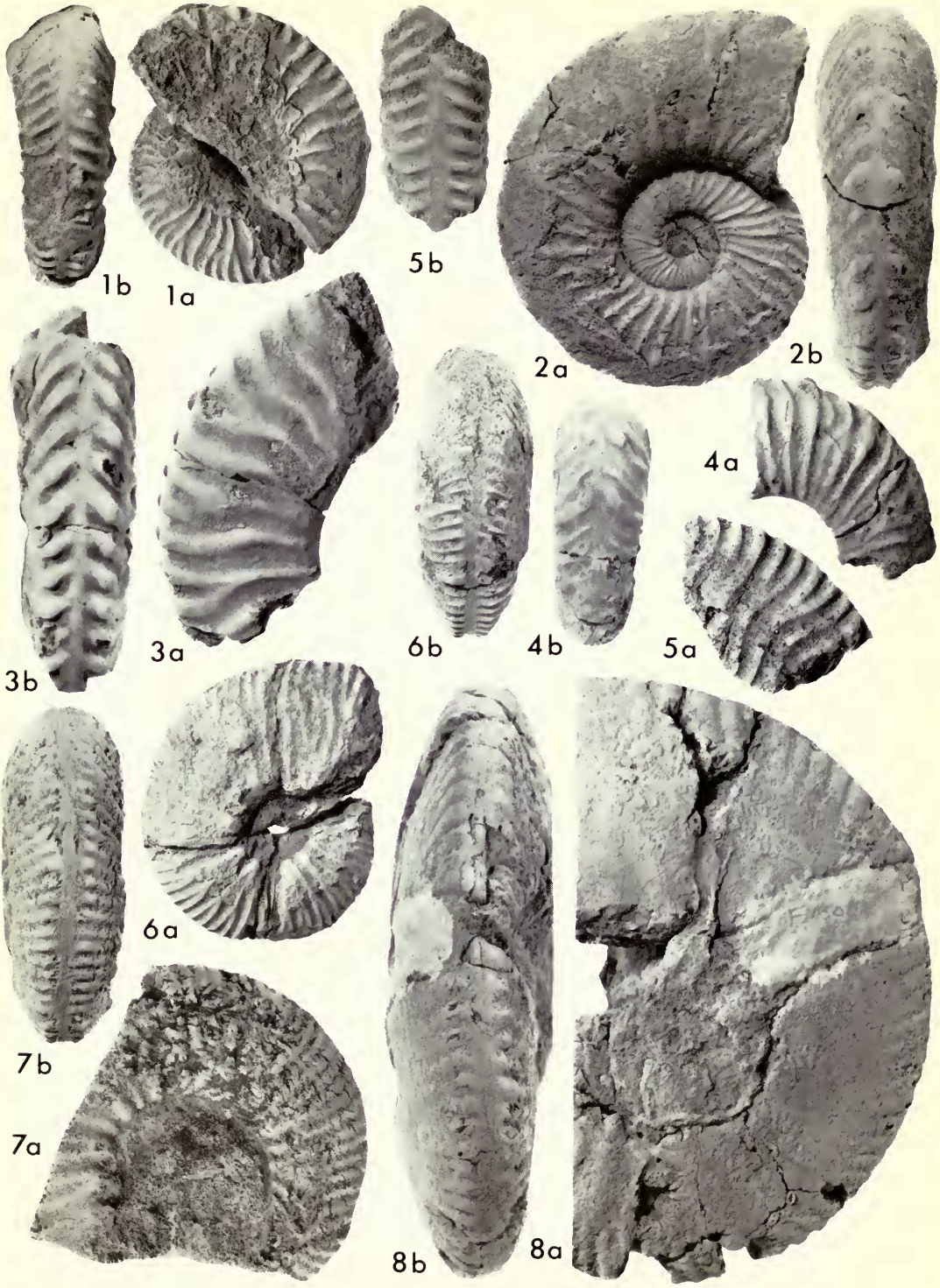

1b
1a
5b
2a
2b
3b
3a
6b
4b
4a
5a
6a
7b
7a
8b
8a

PLATE 12

Neohoploceras collignoni sp. nov. (p. 291)

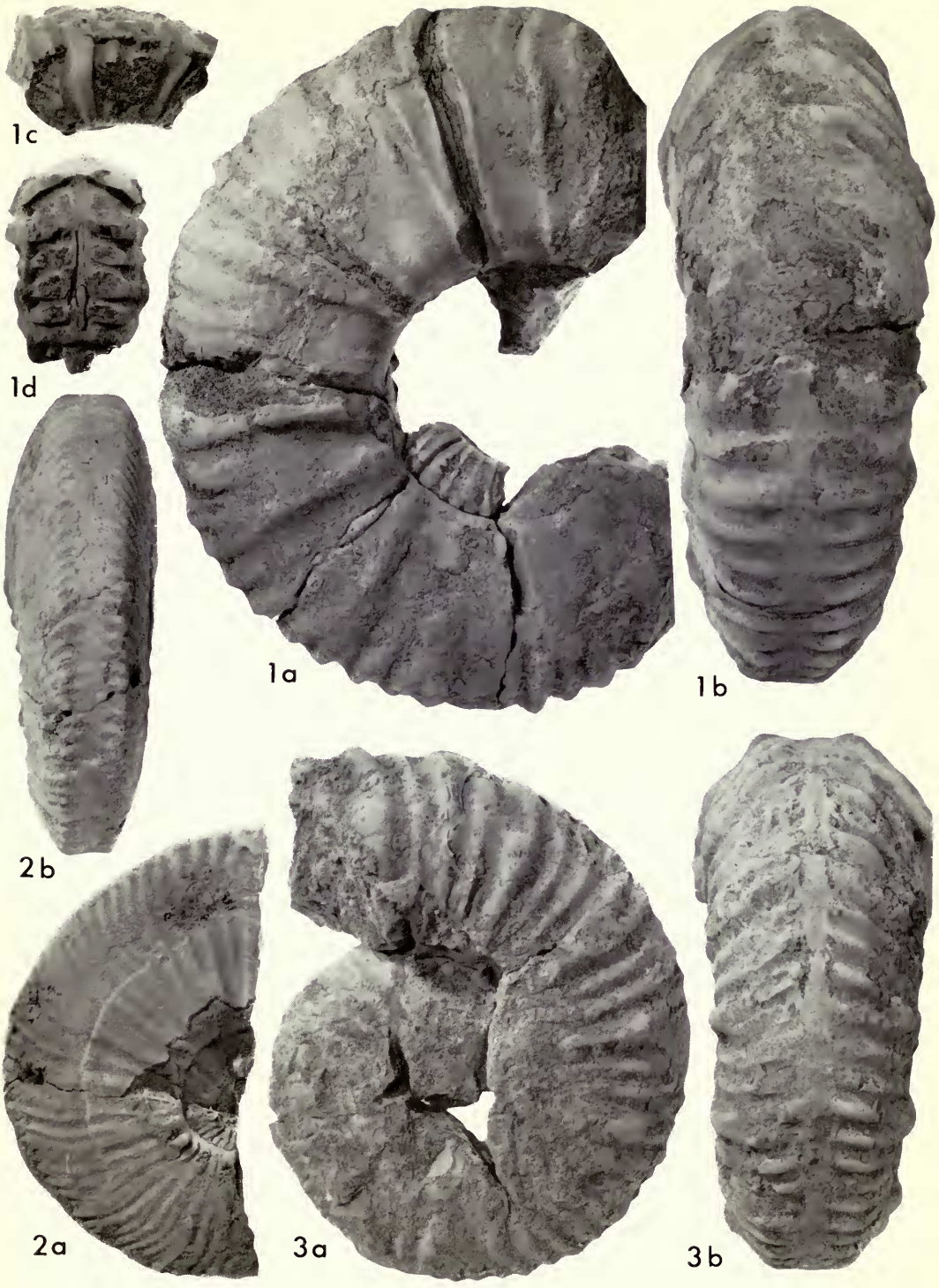
FIGS 1a, 1b, 1c, 1d. U. Valanginian. SW of Malla Khel, Trans Indus Range. C.79249, holotype. Figs 1a, 1b, ×0·6. Figs 1c, 1d, ×1·0.

Sarasinella uhligi Spath (p. 288)

FIGS 2a, 2b. L. Valanginian. Makerwal, Trans Indus Range. C.79240, ×1·0.

Neohoploceras baumbergeri Spath (p. 290)

FIGS 3a, 3b. L. Valanginian. SW of Malla Khel, Trans Indus Range. C.79245, ×1·0.


1c
1d
1a
1b
2b
2a
3a
3b